The Electrical Industry's Weekly Magazine

January 21, 1957

Electrical World

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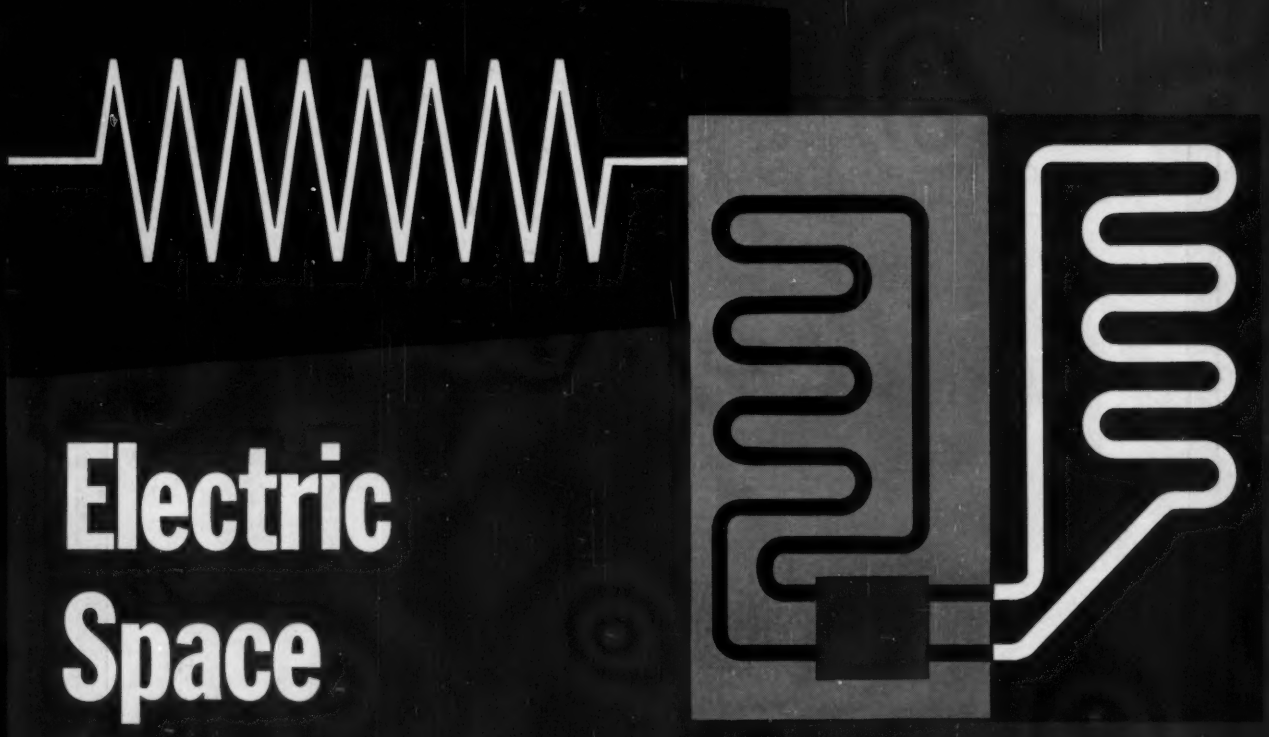


Electric Space Heating: How Soon for You?

. . . page 71

Will Utilities Build A-Plants Now—or Wait? . . . page 61

E B POWER GS W 12
UNIVERSITY MICROFILMS IN
313 N 1 ST
ANN ARBOR MICH

Compare Allis-Chalmers Regulators with Others

How to Save 75% on Service

Unit Construction of Allis-Chalmers Regulators permits on-the-spot service

All that's needed is a two-man crew in a light pickup truck to set up the hydraulic jack and take care of inspection on the spot.

Inspecting other regulators usually requires moving the regulator and piecemeal untanking... using larger crews and expensive equipment. This costs 4 to 5 times more.

Unit construction means you remove only the bolts from cover and control for untanking. This simplified process can save 75% of service costs.

For complete information on these dollar-saving regulators, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS A-C ALLIS CHALMERS

A-5141

Electrical World

Vol. 147, No. 3 JAN. 21, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Features

CURRENT EVENTS

A-Plants: Build Now—or Later?

EW survey shows new utility groups may build reactors of various sizes and types.....p 61

GENERATION

Redondo Plant Control Is Centralized

Six men can operate four 72-Mw units and seven boilers. Will pay for itself in five years.....p 64

METERING

Tests Universal Polyphase Meters

Texas Electric Service designs self-contained polyphase meter and one for use with instrument transformers.....p 66

TRANSMISSION

Wood H-Frames Cut Costs of 230-Kv Line

Design enables New York State G&E to save both materials and labor. Crew can frame four structures a day..p 68

Special Report

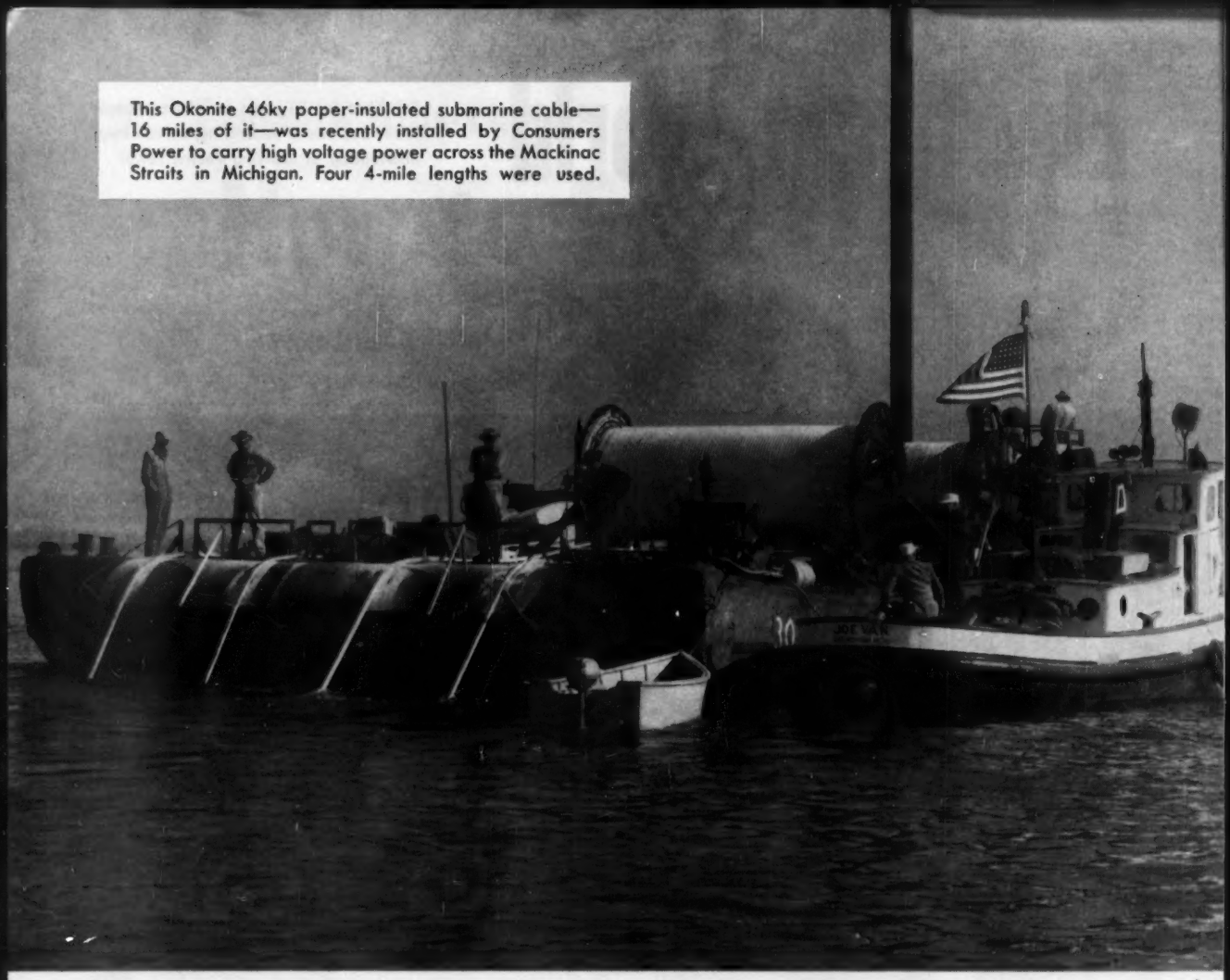
Electric Space Heating

This is a more complete report on EW's Electric Space Heating and Heat Pump Conference which brought out the growing importance of this market to utilities.....p 71

Departments

Atomic Progress 61
Books 118
Catalogs and Bulletins.....112
Editorials 55
• Electrical Newsletter 35
From the Publisher..... 5
How To 89
• Management Newsletter 129
Manufacturers and Markets.....122
Meetings Calendar 134
New Equipment 102
News About People.....124
News-Beat 63
Sales Assignments 120
Selling 96
Technical Literature 114
Washington Wire 58
Readers Forum 140

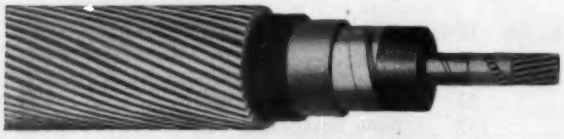
INDEX TO ADVERTISERS.....147



This Okonite 46kv paper-insulated submarine cable—16 miles of it—was recently installed by Consumers Power to carry high voltage power across the Mackinac Straits in Michigan. Four 4-mile lengths were used.

New Consumers Power circuit links upper and lower Michigan for first time

For critical power installations like this one, leading utilities most often place their confidence in Okonite.



Okonite solid type paper-insulated 46 kv submarine cable

Here's why.

With few exceptions, paper-insulated cables are purchased under the basic AEIC specification. But this "spec" does not take into account the experience, the manufacturing methods, or the service records of the manufacturer. And when you buy a cable like the one illustrated above, *these assurances of extra quality are of utmost importance to you.*

Combine these with the carefully researched and tested components of Okonite paper-insulated cables and you have real circuit security. Available with either copper or aluminum conductors, these features are discussed in detail in Bulletin EW-1052. Write for it today. The Okonite Co., Passaic, N. J.

***where there's electrical power . . . there's* OKONITE CABLE**

4320

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. . . *from the publisher*

Few of us in active business have time to read. That is, have *time to read* in a wasteful manner. But we all have *time to read* things that give us maximum information with a minimum of effort. We all have *time to read* the things we read for pleasure. And we all have *time to read* the things we want to know about "just one time."

This "just one time" is a real problem. It is one we all face. We read a story in the morning paper, again in the evening paper, and then perhaps a week later in both Time and Life.

If we are more conservative with our time by carefully picking out the best sources for specific information and then reading that source only, we will have plenty of time to read—time to read all of the worthwhile material available on the Electrical Industry.

That is what you have in Electrical World each week. It gives you all of the important industry news—technical, statistical, managerial, and political. It is easily found through the contents page, pointed up on this page, summarized on page 36 and detailed to your liking in the remainder of the magazine.

We are trying hard to help you "have time to read."

That is what this publisher's column is dedicated to and that is what the editors of Electrical World pledge to you—our readers.

Fischer Black

ABP **ELECTRICAL WORLD** ABC

Published weekly by McGraw-Hill Publishing Co., Inc., Executive, Editorial and Advertising Offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Office, 99-129 North Broadway, Albany 1, N. Y.

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he can switch your 12 kv feeders anywhere, any time, under any load with a hook stick using an S&C LOAD INTERRUPTER

The stick-operated S&C Alduti Load Interrupter in use

Sure! The switching of your 12 kv distribution feeders is getting tougher and tougher! Maybe your linemen are living with it, or maybe you are spending a fortune just to get by.

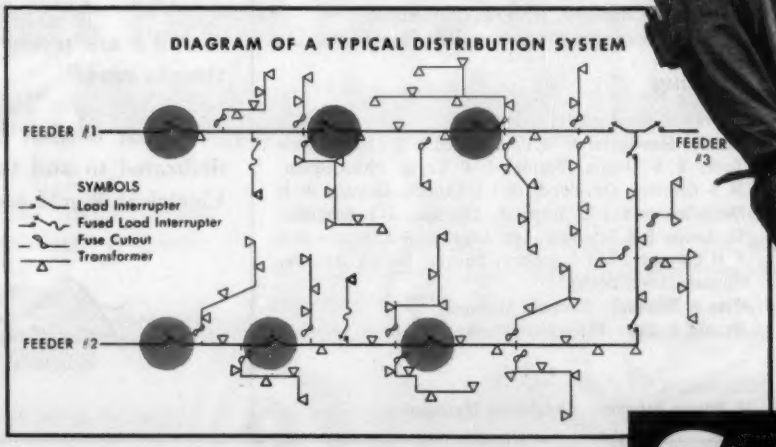
Is there another alternative?

Certainly! A stick-operated S&C Load Interrupter. It can switch positively—under any condition—any load, whether it's line charging current, capacitor charging current, magnetizing current, or full load. And it can be done without the hazards and uncertainties of an external arc. Here's a switch that will keep your linemen happy, and the comptroller, too.

USE IT AT SECTIONALIZING POINTS

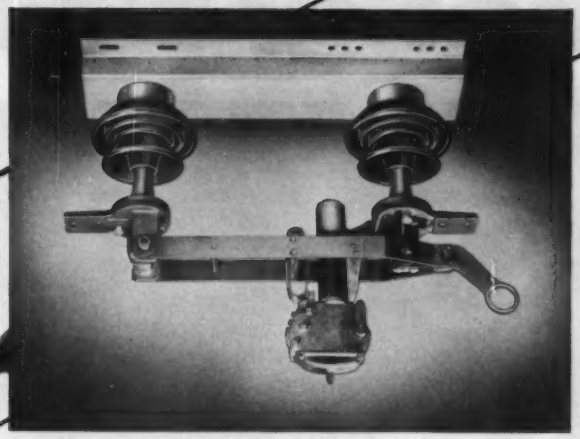
On 12 kv *radial* circuits, increased loads have made switching at sectionalizing points virtually impossible with conventional disconnects. On *loop* circuits (right) it's difficult enough where the duty involves only switching in parallel. And if the tie switches are open, hazard-free circuit interruption can be an impossibility.

Here, S&C Load Interrupters will give you safe, positive, circuit interruption on full line voltage and full load current—an advantage under emergency conditions, and a convenience under normal circumstances.



Specialists in High-Voltage Circuit Interruption since 1910

S&C



The S&C Load Interrupter, Alduti type; outdoor, single pole, (stick-operated); 14.4 kv, 600 amp. Three-pole, group-operated load interrupters are also available.

Load Interrupter Performance Comparison

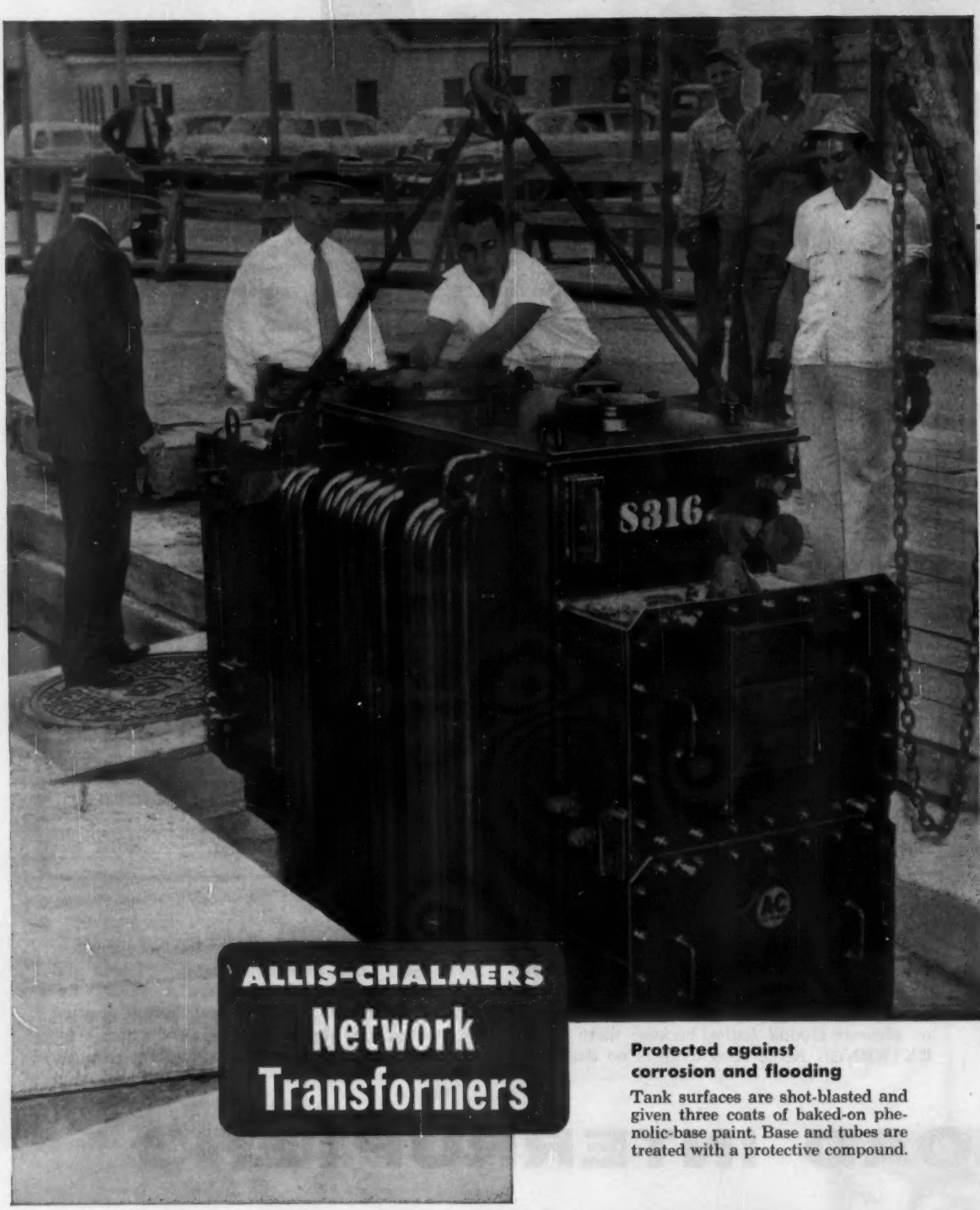
PERFORMANCE	S&C Load Interrupters		Conventional Disconnects	
	Stick-Operated	Group-Operated	Stick-Operated	Group-Operated
Interrupt current from parallel sources safely?	YES	YES	DOUBTFUL	DOUBTFUL
Safe to equipment or personnel if inadvertently opened on full voltage (in case loop is open)?	YES	YES	NO	DOUBTFUL
Dump load without opening feeder breaker, or without preliminary unloading?	YES	YES	NO	DOUBTFUL
Multi-pole device controllable from ground (may be required by system practice or other circuits on same pole)?	NO	YES	NO	YES
Interrupt line charging current safely?	YES	YES	NO	DOUBTFUL
Cost?	LOW	HIGHEST	LOWEST	HIGH

The S&C Load Interrupter can switch the circuit without unloading preliminaries and without opening the breakers. The use of S&C Load Interrupters cannot lead to dangerous phase-to-phase or phase-to-ground faults, because there is NO EXTERNAL ARC. Also there is no danger to men or equipment in case of inadvertent operation. The S&C Load Interrupter breaks all load and charging currents instantly and decisively. Besides, you can mount it in any desired position —vertical, upright, or inverted. Write today for Catalog Section 760 on S&C Load Interrupters.

LOAD INTERRUPTERS

S&C ELECTRIC COMPANY

To meet growing



ALLIS-CHALMERS
Network Transformers

Protected against corrosion and flooding

Tank surfaces are shot-blasted and given three coats of baked-on phenolic-base paint. Base and tubes are treated with a protective compound.

ALLIS-

system needs

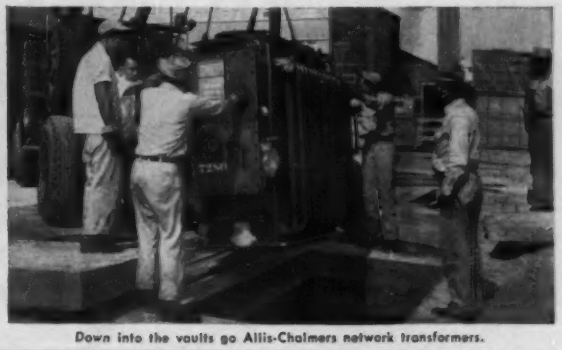
. . . in
Corpus Christi,
Texas

Central Power and Light Company Installs Allis-Chalmers network transformers for its own office building

As a utility, Central Power and Light Company has had the opportunity to observe and compare the performance, reliability and maintenance advantages of many makes of transformers. An application of Allis-Chalmers network transformers *at* CP&L's office building is shown here.

If you are planning to modernize or expand your network systems, investigate the many advantages of Allis-Chalmers transformers — advantages that have merited the complete confidence of Central Power and Light Company and utilities everywhere. For all the facts, contact your nearby Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Up goes another building in bustling Corpus Christi.



Down into the vaults go Allis-Chalmers network transformers.

High thermal capacities

Liberal ducts throughout both the high voltage and low voltage coils assure ample circulation of cooling liquid.

Special design of bushing seal

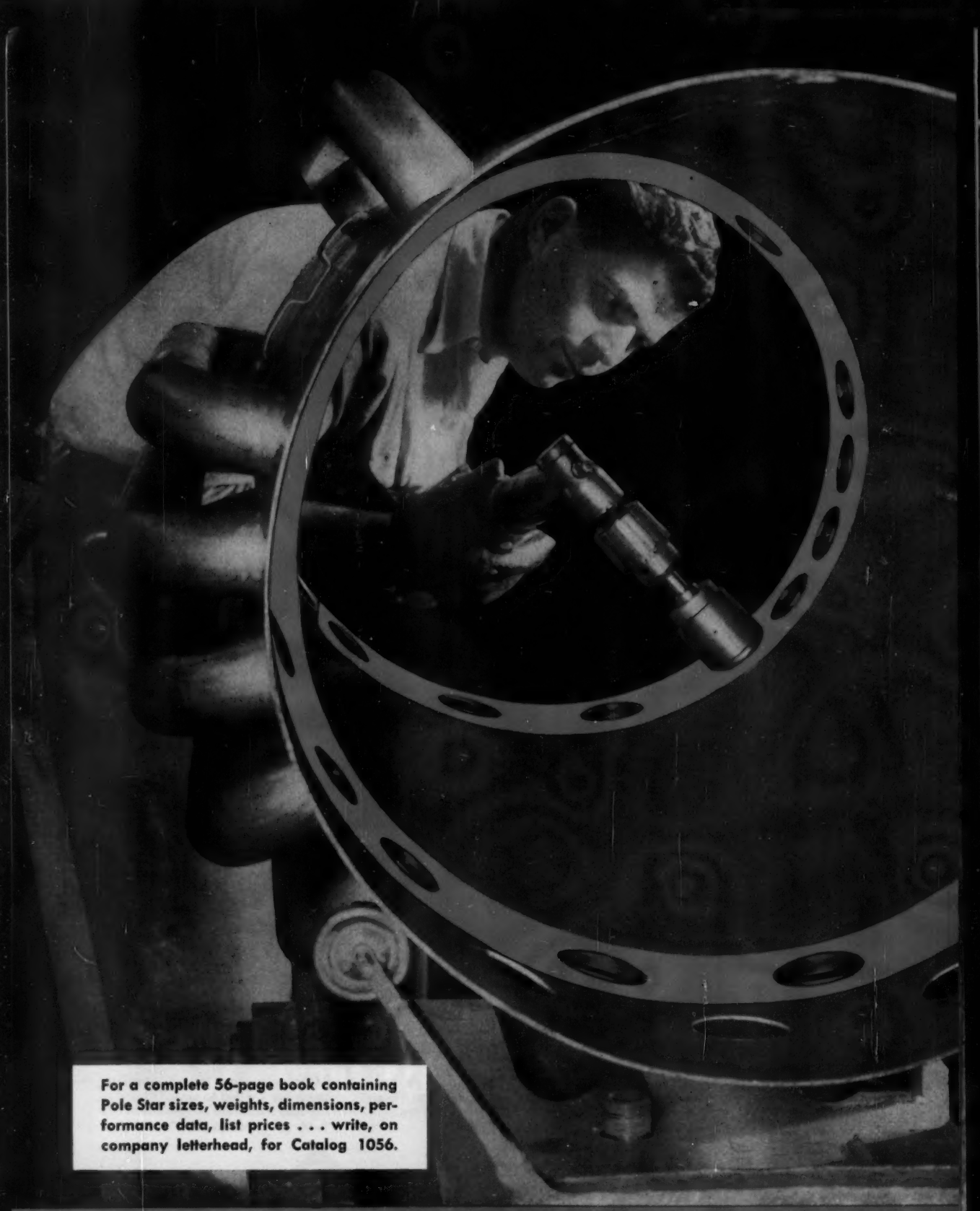
Spiral-wound metallic gaskets adjust to changing operating conditions. Can be installed without grease or cement.

Major gaskets eliminated

Main cover and switch compartment are welded to tank. Oil sludging and oxidation of insulation are held to a minimum.

CHALMERS

A-5198



For a complete 56-page book containing Pole Star sizes, weights, dimensions, performance data, list prices . . . write, on company letterhead, for Catalog 1056.

PENNSYLVANIA TRANSFORMER COMPANY
CANONSBURG, PENNSYLVANIA • Greater Pittsburgh District

Round and 'round

he goes . . . . to expand

POLE STAR's

high overload capacity

The use of cooling tubes on units 25 kva and larger gives Pole Star distribution transformers the efficient cooling needed for high overload capacity. By providing a "passage-way" out of and then back into the tank, tubes permit a naturally faster — and freer — circulation of oil than is possible with any tubeless design. Heat must pass only through the walls of the tubes before being dispersed into the surrounding atmosphere.

Such efficient cooling contributes to high transformer overload capacity in two ways: by preventing too sharp a rise in temperature whenever the normal operating capacity of the transformer is exceeded, and by quickly dissipating any excessive heat just as soon as possible after the overloading has ceased. The latter point, it should be noted, is extremely important so far as *long range* overload capacity is concerned, since rapid cooling helps prevent potentially harmful sustained periods of overheating.

In keeping with Pennsylvania Transformer Company's insistence upon the highest quality, cooling tubes are given a "double seal" where they enter the tank wall. The ends of the tubes are pneumatically expanded, as pictured, so tightly against the tank wall that there are no external crevices or openings in which moisture might collect. Thus, tube ends can be welded *inside* the tank, where there is ample clearance for a thorough job, and where there can be unhampered inspection of the welded joints.

167 Production Controls make Pole Star Best!

POLE STAR

3 through 500 kva
through 67,000 volts

NOW... you can obtain the advantages of the I-R UNIT-TYPE

Here's how the I-R Unit-Type rotor design contributes to dependable pump performance with minimum operating and maintenance expense.

HIGH EFFICIENCY— throughout years of operation

The simplicity of Unit-Type rotor design with precision-matched impellers and channel ring sections plus simple, direct fluid passages results in high operating efficiency. Efficiency stays high, too, because clearances are realistic and can be maintained without frequent replacement of wearing parts.

EASIER MAINTENANCE— and less of it

The Unit-Type rotor permits quick and easy removal of the entire rotor assembly without disturbing suction and discharge connections. All parts of the assembly are readily accessible, and easy to remove and reassemble. There are no shrink fits or delicate alignment problems.

GREATER INTERCHANGEABILITY— smaller spare parts inventory

Maximum interchangeability of rotor-assembly parts makes it unnecessary to stock separate replacement units for each individual stage. Except for the suction and discharge stages, impellers and channel rings are completely interchangeable.

SYMMETRICAL CASING— for greater strength

Unit-Type rotor assembly eliminates intricate hydraulic passages in the casing. The symmetrical casing provides greater strength, minimizes thermal distortion, and permits an attractive, streamlined exterior appearance.

FLEXIBILITY OF DESIGN— permits changes in operating conditions

Changes in operating conditions can be met easily by installing a new combination of impellers and channel rings on the original shaft...in the original casing. Forseeable changes in operating conditions can also be met by using "dummy" stages which can later be replaced by complete working assemblies. Unit-Type rotor design and smooth bore casing makes this possible.

FOR FURTHER INFORMATION— see your nearest I-R representative

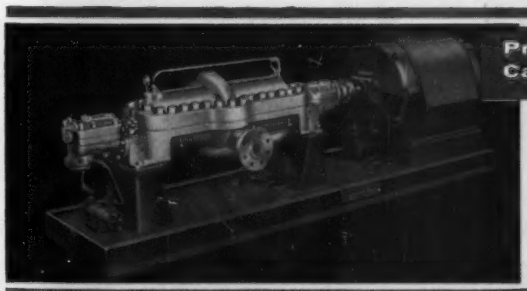
Your local I-R Sales Engineer will welcome the opportunity to work with you in the selection of boiler-feed pumps best suited to your requirements. Ask him to tell you about the latest advances Ingersoll-Rand has made in pumps for condenser circulating, condensate, heater drip and other power plant and central station services.

Ingersoll-Rand

30-440 **11 Broadway, New York 4, N. Y.**

ROTOR ASSEMBLY

in a complete line of boiler-feed pumps for pressures from 300 to 6500 psi

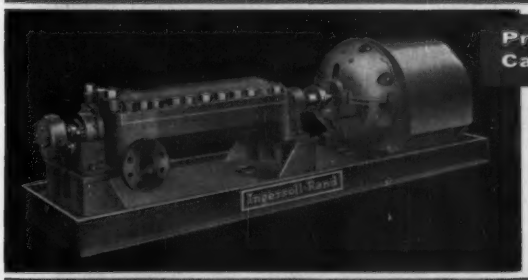


Pressures: 300 to 1000 psi
Capacities: to 700 gpm

Class CNTA

Recommended for medium pressure installations, the Ingersoll-Rand Class CNTA is today's most modern and efficient multi-stage boiler-feed pump in its pressure class.

It has a smooth-bore, symmetrical casing and features opposed impeller groups to neutralize axial thrust. Bearings can be either sleeve- or ball-type.

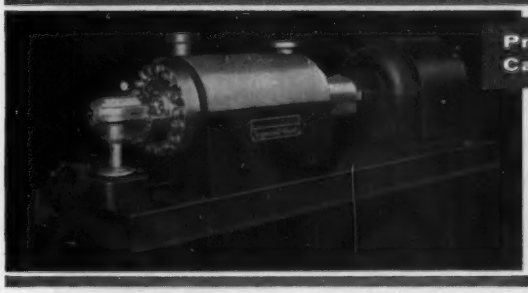


Pressures: to 1200 psi
Capacities: to 1600 gpm

Class HMTA and HMTB

I-R Class HMTA and HMTB multi-stage centrifugal pumps feature a symmetrical, horizontally-split casing and "in-line" staging.

Supplied in from 3 to 9 stages, they are widely installed as boiler-feed pumps in central stations and industrial plants. Ball- or sleeve-type bearings are available.



Pressures: to 6500 psi
Capacities: to 2800 gpm

Class CHTA and CHTB

Of the double-case design, Class CHTA and CHTB multi-stage centrifugals consist of a vertically-split inner assembly enclosed in a heavy cylindrical outer casing.

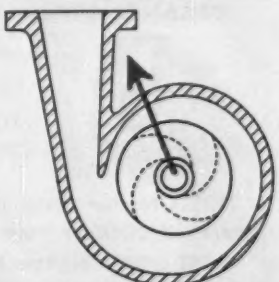
More of these Ingersoll-Rand pumps are installed in high-pressure boiler-feed service than any other make—indisputable proof of their overwhelming acceptance by modern central stations.

Thrust forces balanced with multiple-volute design

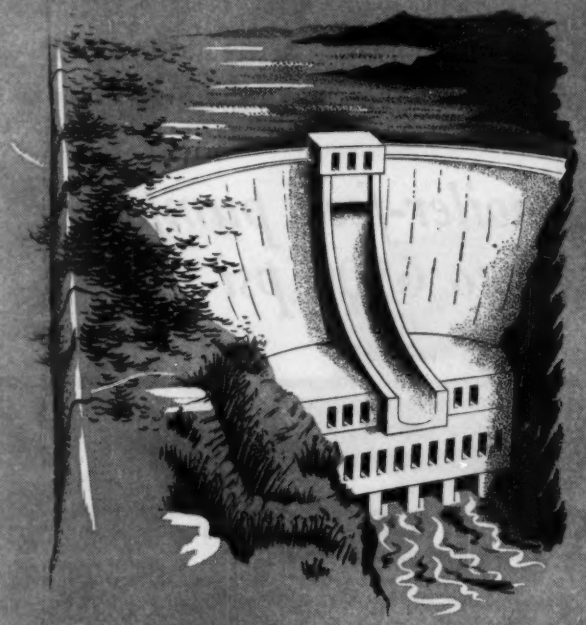
COMPLETE RADIAL BALANCE—a feature of all these I-R boiler-feed pumps

Evenly spaced volute passages around the entire circumference of the impeller balance the radial thrust force. That is, the radial forces become equal in all directions with a zero resultant on the impeller.

With a single volute casing, a radial thrust force is created due to the uneven pressure distribution around the periphery of the impeller. This force tends to deflect the shaft and cause the rings to rub with a loss in efficiency.



Thrust on impeller unbalanced in single volute design



FERRANTI

Transformers for Hydro-Electric Schemes

As specialists in the manufacture of transformers for more than 65 years, FERRANTI LTD. have been associated with many of the world's largest hydro-electric schemes. More recent achievements include contracts for over 4,000,000 kVA of large high voltage power transformers, among which are :—

CENTRAL AFRICA

Two 120,000 kVA and ten 60,000 kVA 330,000 volts three-phase Transformers have been ordered by the Central African Federation Power Board for the Kariba Hydro Electric Scheme. This is the largest overseas transformer contract ever to be placed in the United Kingdom.

CANADA

Seven 71,000 kVA, 301,400 volt single-phase Ferranti generator transformers and six 37,000 kVA, 275,000 volt step-down Ferranti transformers have been ordered by the Aluminum Company of Canada Ltd. for the Alcan Project at Kemano and Kitimat, British Columbia. Four of the generator transformers and all of the supply transformers are now in commission.

U.S.A.

GARRISON DAM PROJECT Nine 33,333 kVA, 230,000 volt single-phase Ferranti transformers forming three 100,000 kVA banks have been supplied to the U.S. Army Corps of Engineers for the Garrison Dam Project, North Dakota.

McNARY DAM PROJECT Six 56,000 kVA, 230,000 volt, single-phase transformers have been ordered by the U.S. Army Corps of Engineers for the McNary Dam Project, Oregon.

DALLES DAM PROJECT The contract covers eighteen 63,000 kVA, 230 kV and three 63,000 kVA, 115 kV, single-phase transformers for the U.S. Army Corps of Engineers Dalles Dam Project, Columbia River.

NEW ZEALAND

Twenty-six Ferranti large power transformers have been ordered by the State Hydro-Electric Department of New Zealand. Thirteen 14,800 kVA, single-phase, 50 cycles, 11/220 kV transformers have been supplied and thirteen 9,259 kVA, single-phase, 50 cycles, 11/220 kV transformers have been supplied to Wheakamaru.

INDIA

Three Ferranti 20,000 kVA, OFB, 3-phase, 50 cycles, 132/33·66 kV transformers with on-load tap changing gear and two Ferranti 10,000 kVA, ONIOB, 3-phase, 50 cycles, 132/33 kV transformers with on-load tap changing gear have been supplied for the Damodar Valley Power Scheme in India.

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London Office: KERN HOUSE · 36 KINGSWAY · W.C.2

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WEST GORTON: Manchester 12, England.
GEM MILL: Chadderton, Lancs., England.
EDINBURGH: Ferry Road, Edinburgh 5, Scotland.
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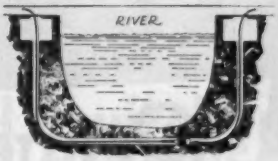
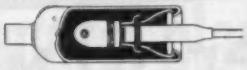
10,000 FEET OF CONDUIT RODDED IN 8 HOURS!

Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.





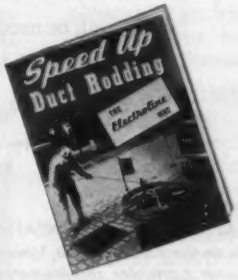
EASY DOES IT!—It's all in a day's work with Electroline Steel Duct-Rodding Equipment rodding 10,000 feet of conduit!

Light in weight, easily handled and stored, low upkeep: these are a few of the advantages utility men know to be true. But even bigger, more important advantages are—

- *Savings in the cost of labor*—for example, where it formerly took two gangs from one to two weeks on a given job, one gang, *in one-half hour*, has completed the same job—using Electroline Duct-Rodding Equipment.
- *Savings in original cost*—you get long life—double that of other types—when you buy Electroline Duct-Rodding Equipment. Add to that this fact: this equipment costs just about half as much for equivalent capacity! *There's true economy.*
- *Savings in Total Investment*—fewer sets are required because of the speed with which a job is completed and the equipment moved to other locations.

Speed up installation, reduce your costs; start now to use Electroline Duct-Rodding Equipment. Available for 3", 3½" or 4" Duct.

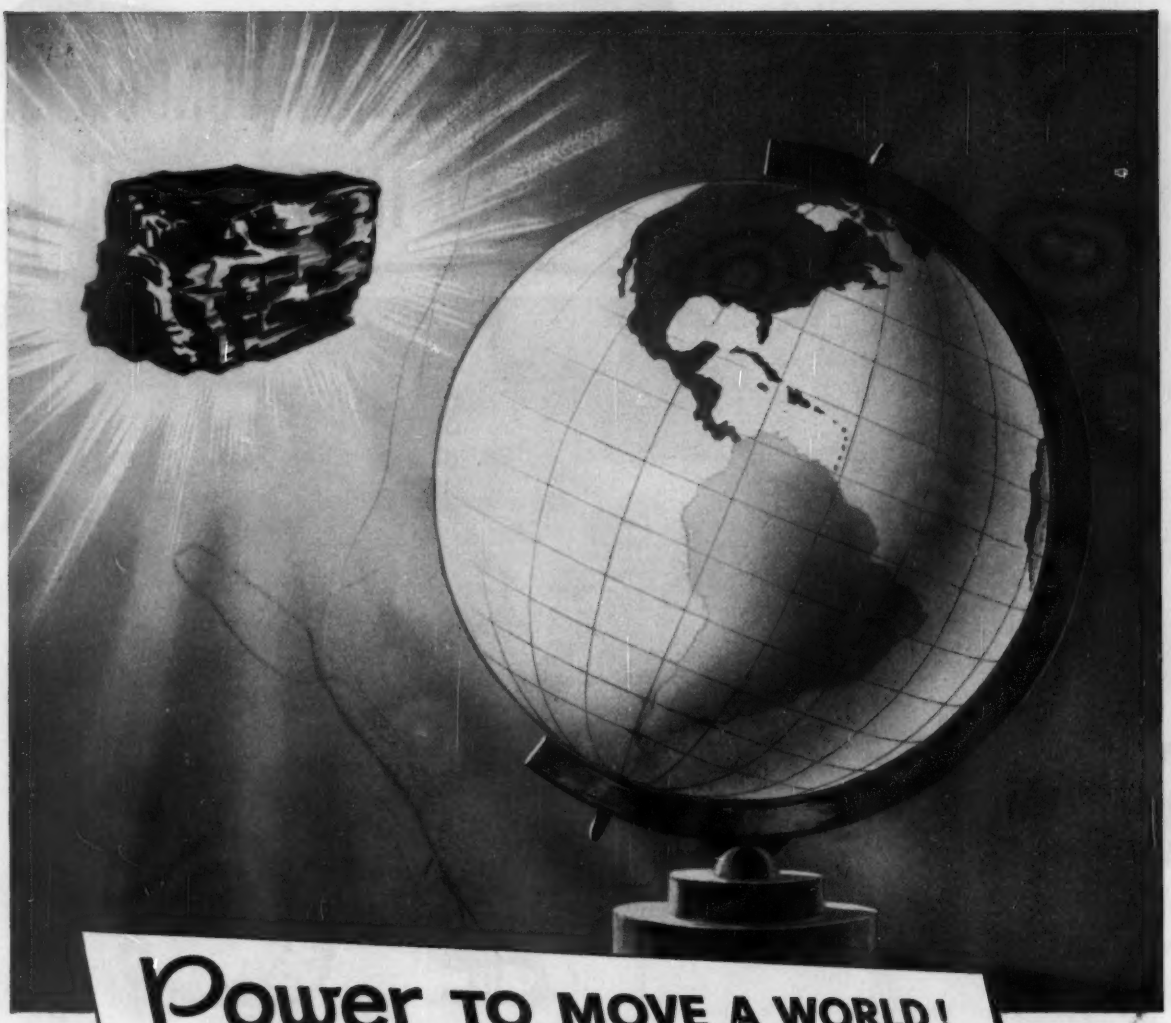
We've got a 4-page brochure which describes and illustrates more completely how this equipment can benefit you. We'll gladly send you a copy. Write us.



OTHER *Electroline* PRODUCTS

Electroline Company

4121 South La Salle St., Chicago 9, Ill.
In Canada: POWERLITE DEVICES, LTD., TORONTO



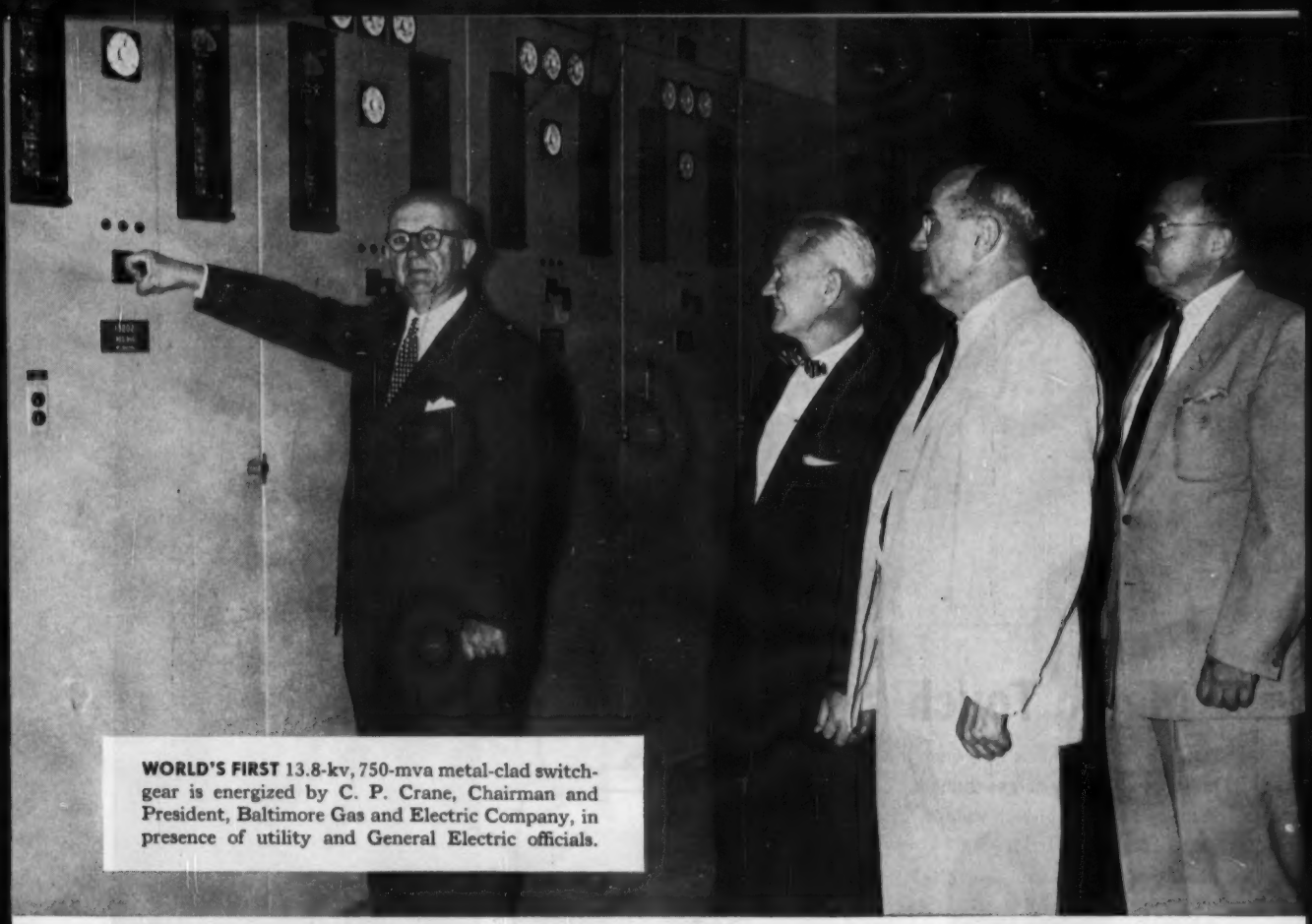
Power TO MOVE A WORLD!

➔ America stands on the threshold of a golden age. The sinews of her dynamic economy are flexed as never before. Increased power for untold requirements will be needed . . . and *met* by the most dependable supply of low-cost energy—*Bituminous coal!*

Proven usable reserves in B&O territory contain billions of tons—*available for centuries to come.*

CONTACT OUR COAL TRAFFIC REPRESENTATIVES!
You'll receive details on the most efficient, low-cost Bituminous coal for your particular requirements—
COAL TRAFFIC DEPARTMENT
B&O RAILROAD, BALTIMORE 1, MD. LExington 9-0400

Baltimore & Ohio Railroad



WORLD'S FIRST 13.8-kv, 750-mva metal-clad switchgear is energized by C. P. Crane, Chairman and President, Baltimore Gas and Electric Company, in presence of utility and General Electric officials.

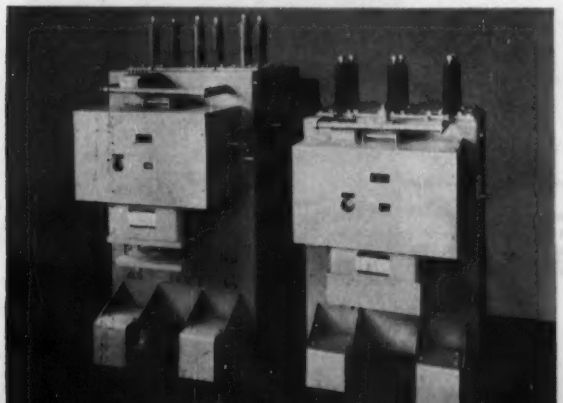
Baltimore Gas and Electric Co. installs

The first 750-MVA metal-clad switchgear

TO PROVIDE FLEXIBILITY for future expansion in the face of load growth problems, Baltimore Gas and Electric Co. took an historic step June 11, 1956, when General Electric's new 13.8-kv, 750-mva metal-clad switchgear was put on the line.

EXTREMELY COMPACT—G.E.'s new 750-mva unit packs 50 per cent more interrupting capacity in ten per cent more floor space than 500-mva equipment.

50% HIGHER CAPACITY—ONLY 10% MORE SPACE. 750-MVA breaker (left) as compared with 500-MVA equipment.



SIMPLE TO MAINTAIN—One man can handle the 750-mva Magne-blast breaker. Vertical lift design makes it virtually impossible to tip over. With double bus layout, feeder breakers can be removed without dropping load.

FOR EXTRA SAFETY, all circuit components are separately enclosed in grounded metal enclosures. Bus compartment, located at top of the unit, is least vulnerable to floods.

MANY UTILITIES face similar load growth problems. G.E.'s new 750-mva metal-clad switchgear points the way to a simple, low-cost solution. Contact your nearest G-E Apparatus Sales Office, or write for bulletin GER-1322—"The Economy of the 750-mva Breaker" to Section 511-18, General Electric Company, Schenectady 5, New York.

LIVE BETTER ELECTRICALLY

Progress Is Our Most Important Product

GENERAL ELECTRIC

"Magic Touch"

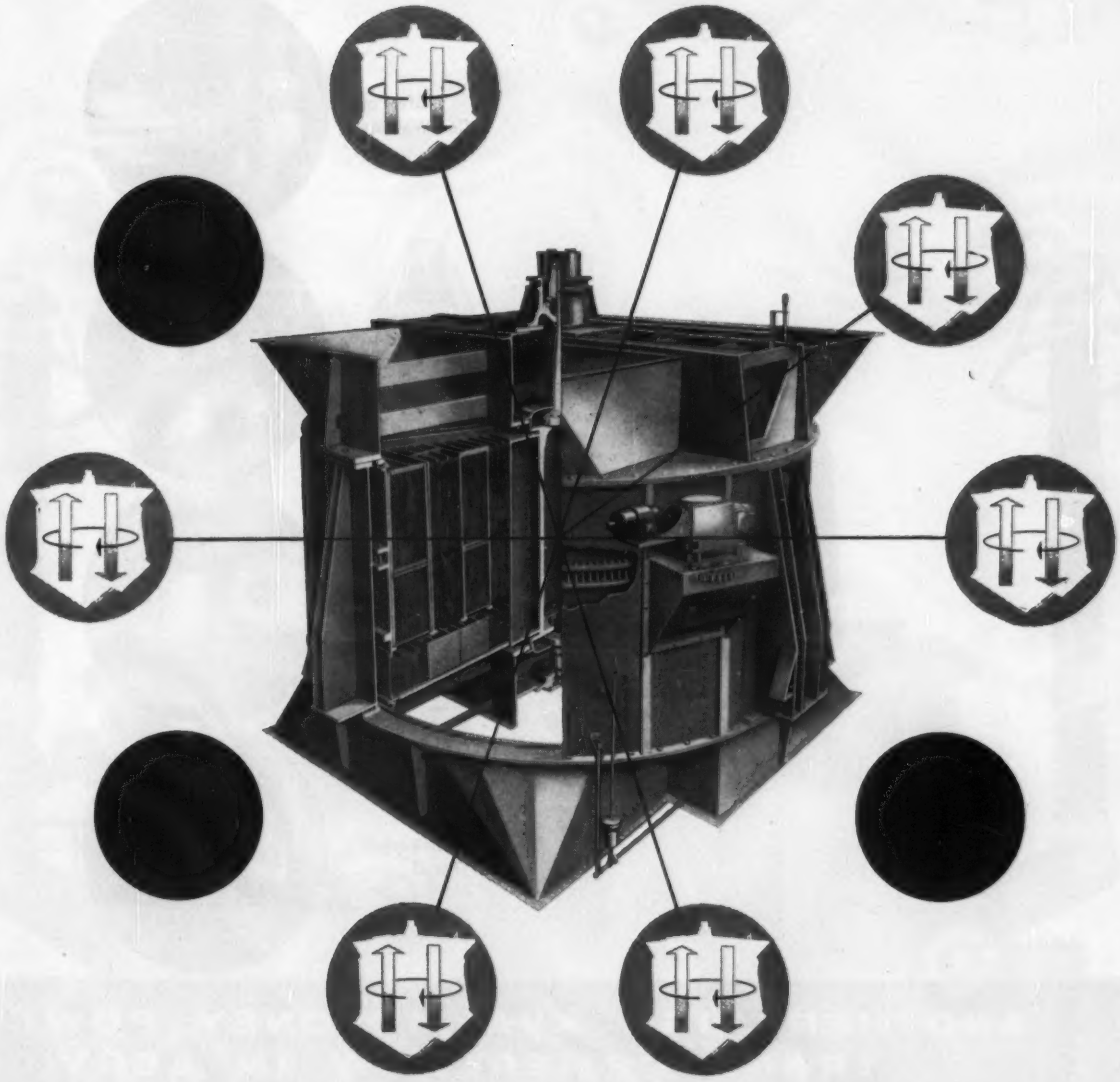
Lights burn and wheels turn when the magic of electricity surges through industry's life line of high voltage cable. Long, intensive testing has proved beyond question that Simplex ANHYDREX XX insulated cable possesses the stability and resistance that assure long, trouble-free service in all environments. Its amazing resistance to ozone and other oxidizing agents make Simplex ANHYDREX XX the logical choice for your high voltage applications. For complete technical data write for Booklet 1023.

SIMPLEX WIRE & CABLE CO.,
79 Sidney Street, Cambridge 39, Mass.

LIVE BETTER ELECTRICALLY

Simplex

ANHYDREX XX



7 out of 10 *air preheater installations are Ljungstrom®*

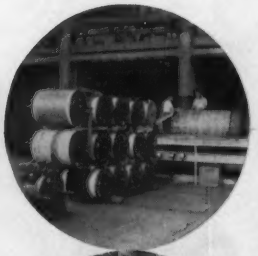
Advantages of the Ljungstrom Air Preheater

- Size for size, recovers more heat than any other type.
- Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.
- Eliminates cold spots . . . keeps corrosion to a minimum.
- Easier, faster to clean and maintain.
- Requires far less supporting steel and is quickly erected.

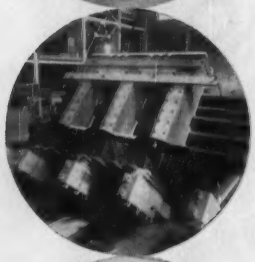
FUEL ECONOMY is the big reason. Size for size, the Ljungstrom recovers more heat than any other type of air preheater. And with every 45-50 F of air preheat you cut your fuel bill 1%.

Write now for your copy of our 38-page manual, for handy reference.

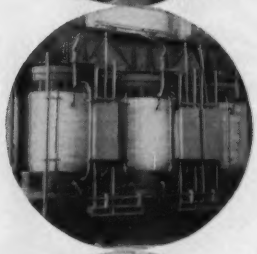
The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.



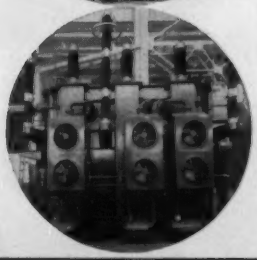
Start of
Coil Winding



Raising Core To
Vertical Position
For Coil Stacking



Assembled Core
and Coil Unit



Completed
Transformer

ME57-1

ANOTHER HIGH KVA MOLONEY POWER TRANSFORMER NOW IN SERVICE

Recently installed in a large southern utility system, this Moloney Power Transformer is now in service.

Rated 135,000 KVA, 3 phase, 60 cycle, F. O. A. Outdoor Type. High voltage 115,000 Y/66,400; Low voltage 13,800 Delta.

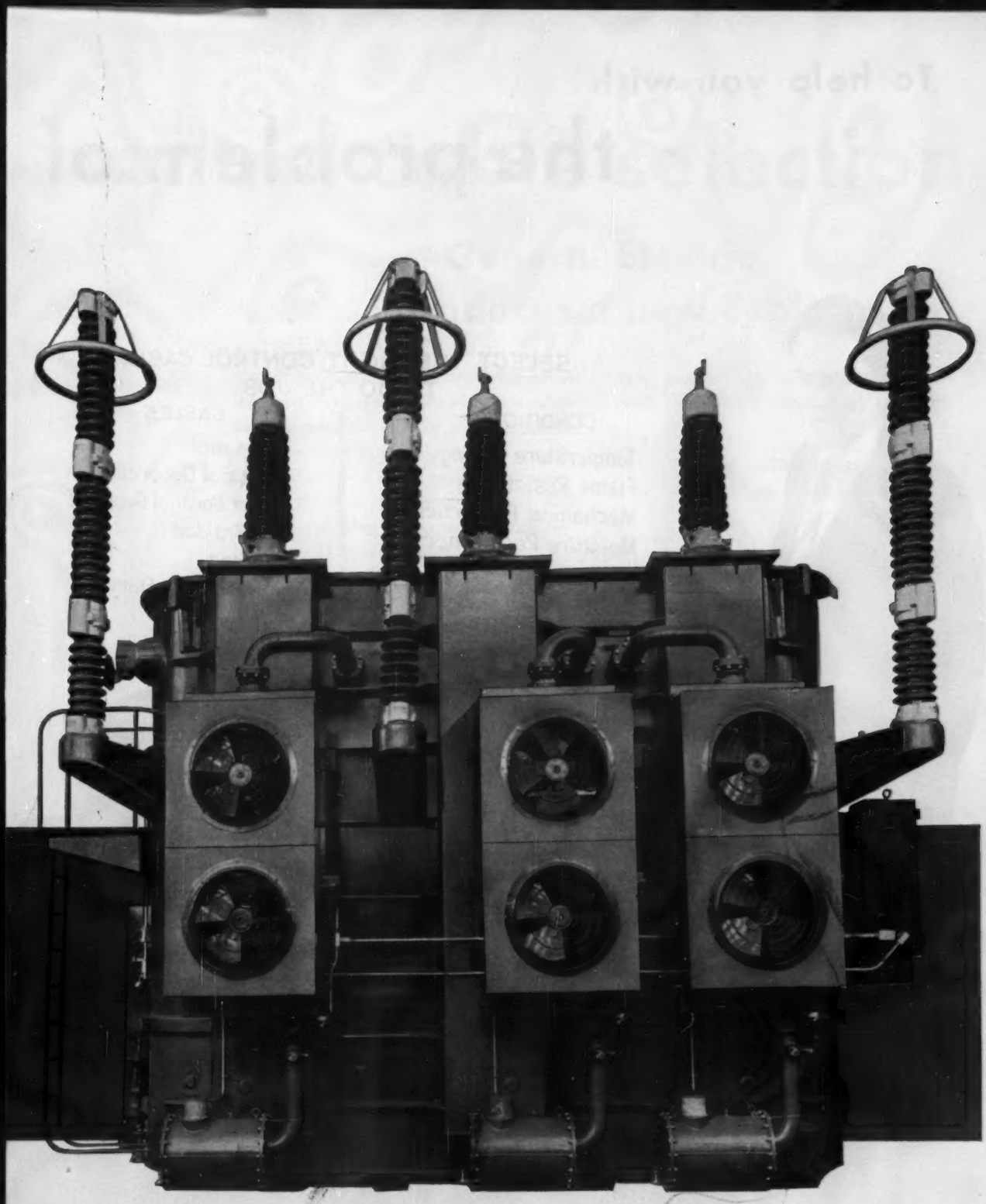
Engineered, designed, fabricated, assembled and tested in the Moloney Factory, this transformer is another one of many which will aid utilities in meeting the ever growing power demands of today and tomorrow.

Consult your local Moloney representative today concerning your power transformer needs.

MOLONEY ELE

Power Transformers • Distribution Transformers • Load Tap Changing Trans-
Network Transformers • Series Street Lighting Transformers *formers*
Subway

SALES OFFICES IN ALL PRINCIPAL CITIES



C T R I C C O M P A N Y

Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers
Transformers • Industrial Dry Type Transformers • Capacitors • Transformers and Inductors for Electronics

FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONT., CANADA

To help you with

the problem of

A. R. Lee, General Electric application engineer, discusses the many conditions affecting the selection of station control cables—and the wide variety of cable types available to handle the job. Recent General Electric cable developments, and men like Lee who work closely with electric utility engineers, are helping to simplify the complex problem of selecting the right control cables for these many conditions.

control cable selection

General Electric introduces a new cable

A number of application problems often face the electric utility engineer who must select the best control cable for a particular installation. Must he consider the electrostatic effects of adjacent power cables? Is it necessary for the cable to be flame-resistant? Will there be a problem of moisture, of high ambients, or of extreme cold?

In any event, there will be a combination of conditions which should be considered in the selection of the cable most suitable for the application.

Polyethylene Flamenol* Control Cable
A new answer for most applications

Out of General Electric's experience in manufacturing *and using* control cables has come the development of another new type of control cable...a cable that will simplify many application problems. It is the new G-E polyethylene Flamenol* control cable. This cable can be used indoors or outdoors, in wet or dry locations, for aerial or direct burial installations. It combines the best properties of both polyethylene and polyvinyl chloride: the polyethylene insulation provides high dielectric strength, low moisture absorption, and low specific inductive capacity; the polyvinyl chloride jackets, both on the single conductors and over core, resist flame, moisture, oil, acid, alkali, sunlight, weather, and abrasion. The cable is rated 75 C copper temperature, 600 volts.

Extreme conditions may call for other cables

There is always the possibility of the extreme and unusual situation. In these cases the full line of General Electric control cables—and the G-E engineers who know them best—can be of particular help to you. These men, through their broad experience in working with electric utility engineers, have become familiar with (and have helped with the solution of) most of the application problems you will face.

For example, if your problem is moisture plus very high ambients, their answer will probably be a silicone-rubber insulated cable with asbestos braid. If you must have flexibility under conditions of extreme cold, Super Coronol* Geoprene* cable provides it. Even if you require resistance to atomic radiations, G-E Wire and Cable engineers can offer a special combination of insulating materials and jackets to do the job.

Whatever your control cable problem, General Electric can help you find the best answer. See your local G-E Wire and Cable specialist, or write Section W181-127, Construction Materials Division, General Electric Company, Bridgeport, 2 Conn.

*Registered Trade-mark General Electric Company

Progress Is Our Most Important Product

GENERAL ELECTRIC

Planetary Roll and

complements the Foster Wheeler line of pulverized fuel systems

THE FOSTER WHEELER Type MB planetary roll and table pulverizer, developed in Germany, is a constant-speed mill which has proved to be exceptionally efficient and economical to operate and maintain.

In the MB pulverizer, grinding action takes place between a slowly rotating horizontal table and three spheroidal rollers, uniformly spaced around the axis of the table and subjected to controlled thrust pressure by a large number of coil springs. The motion of the table causes the rollers to rotate while circling planet-fashion and rolling over the material on the grinding ring.

Air or gas, entering from below the pulverizer table, floats the ground particles up into the classifier, located in the top of the housing. Particles too coarse to float fall back onto the table for further pulverization. All routine adjustments to the spring tension gear or classifier vanes can be made externally while the mill is in operation.

Wide experience abroad indicates that this new addition to the complete line of heavy-duty FW pulverizers offers the following advantages.

1. *Low Power Consumption*
   Assures exceptional economy of operation, year after year.

2. *Low Maintenance*
   Extremely rugged construction and accessibility of wearing parts reduces down-time for servicing.

3. *Uniform Product Fineness*
   Pulverizer and classifier design assures extreme uniformity of particle size.

4. *Pressurized or Suction Operation*
   Provides complete flexibility for various types of service.

5. *All Necessary Adjustments Made Externally with Mill Operating*
   Avoids shut-downs for changes in pulverizer pressure or classifier adjustment.

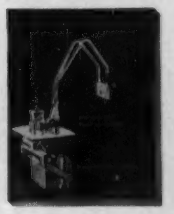
6. *Simple Renewal and Replacement of Grinding Rolls and Table*
   Cuts down-time for infrequent replacement of wearing parts.

THE TYPE MB PULVERIZER, with Foster Wheeler feeders, distributors, burners and fans or exhausters, provides an exceptionally efficient and economical pulverized fuel system.

For complete information on the new PLANETARY ROLL & TABLE PULVERIZER, write for Bulletin MB-55-5.

For full details on Foster Wheeler heavy-duty BALL MILL pulverized fuel systems, write for Bulletin BP-53-3.

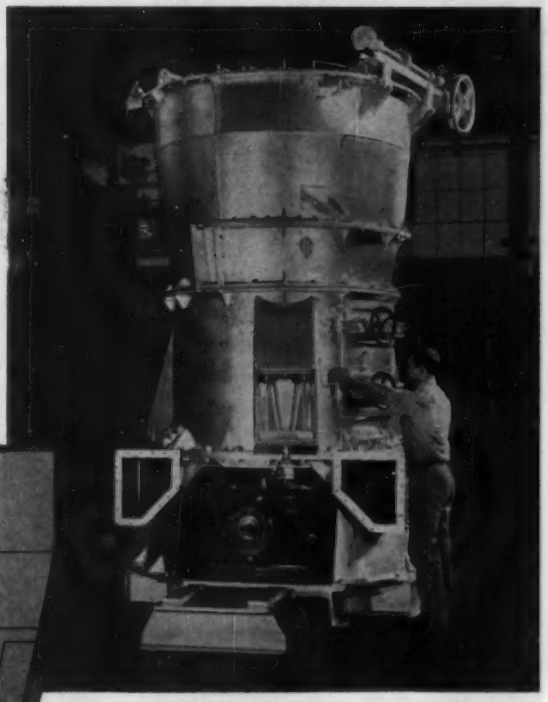
Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.



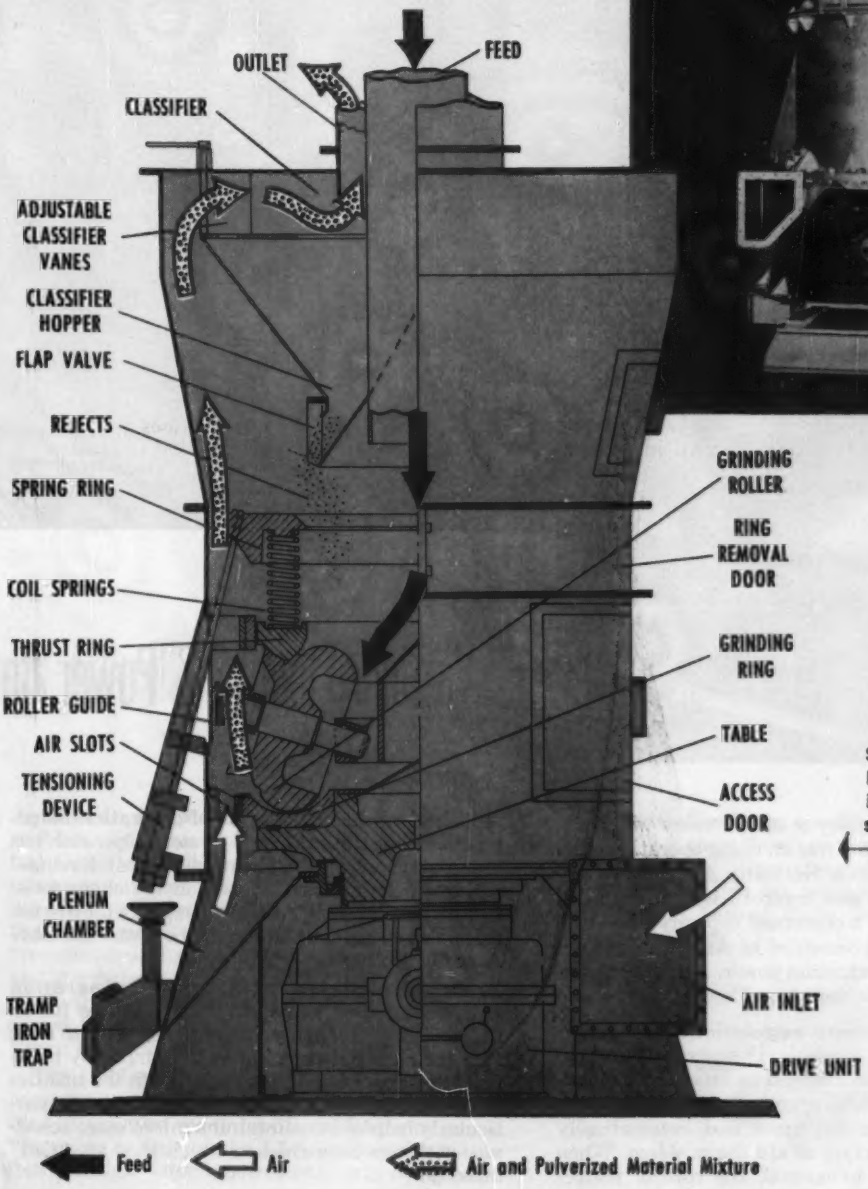
FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

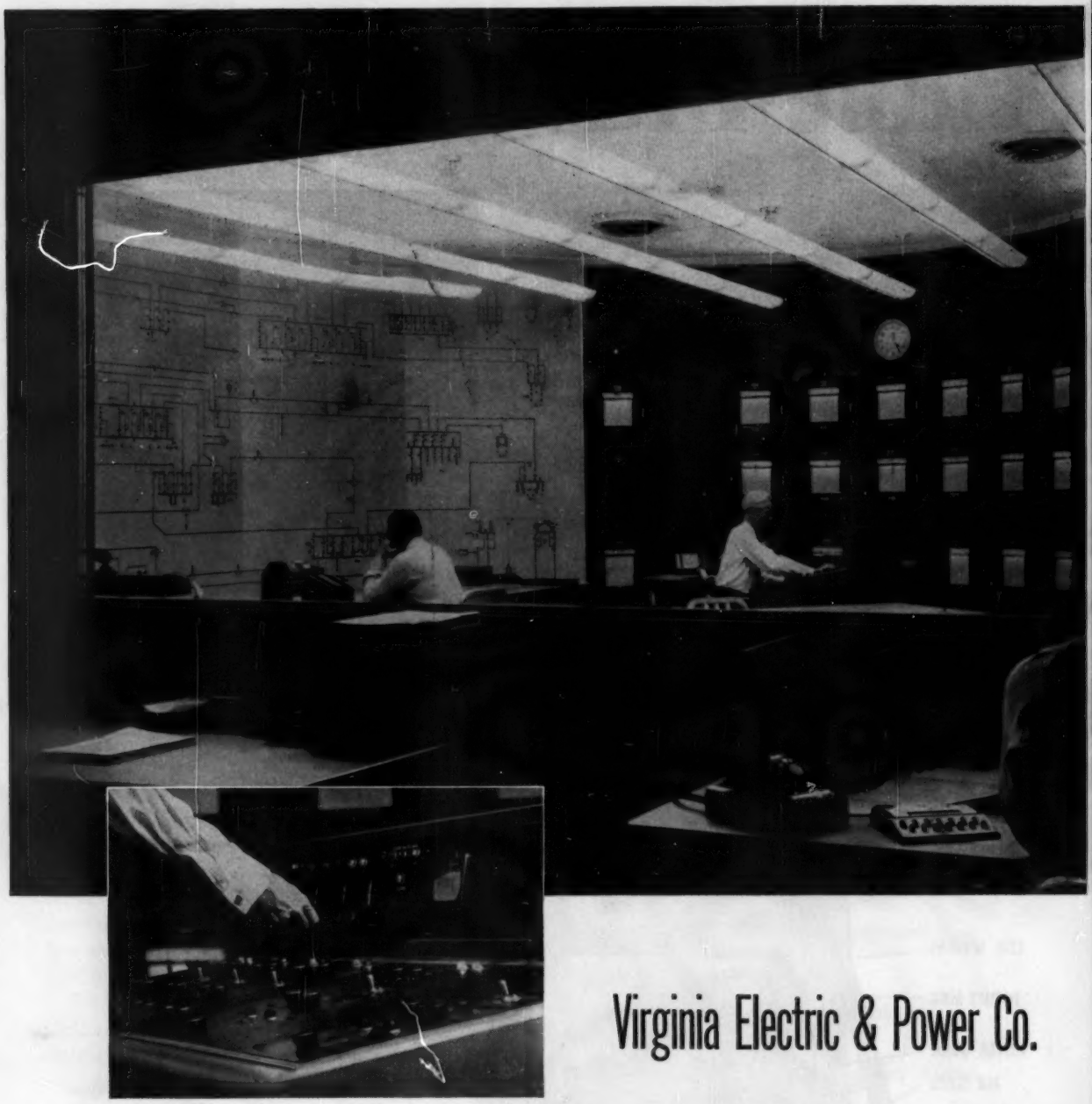
Table Pulverizer



Exterior view of completely assembled Foster Wheeler Type MB planetary roll and table pulverizer.



Sectional drawing of Type MB pulverizer with parts identified to show construction and operation.

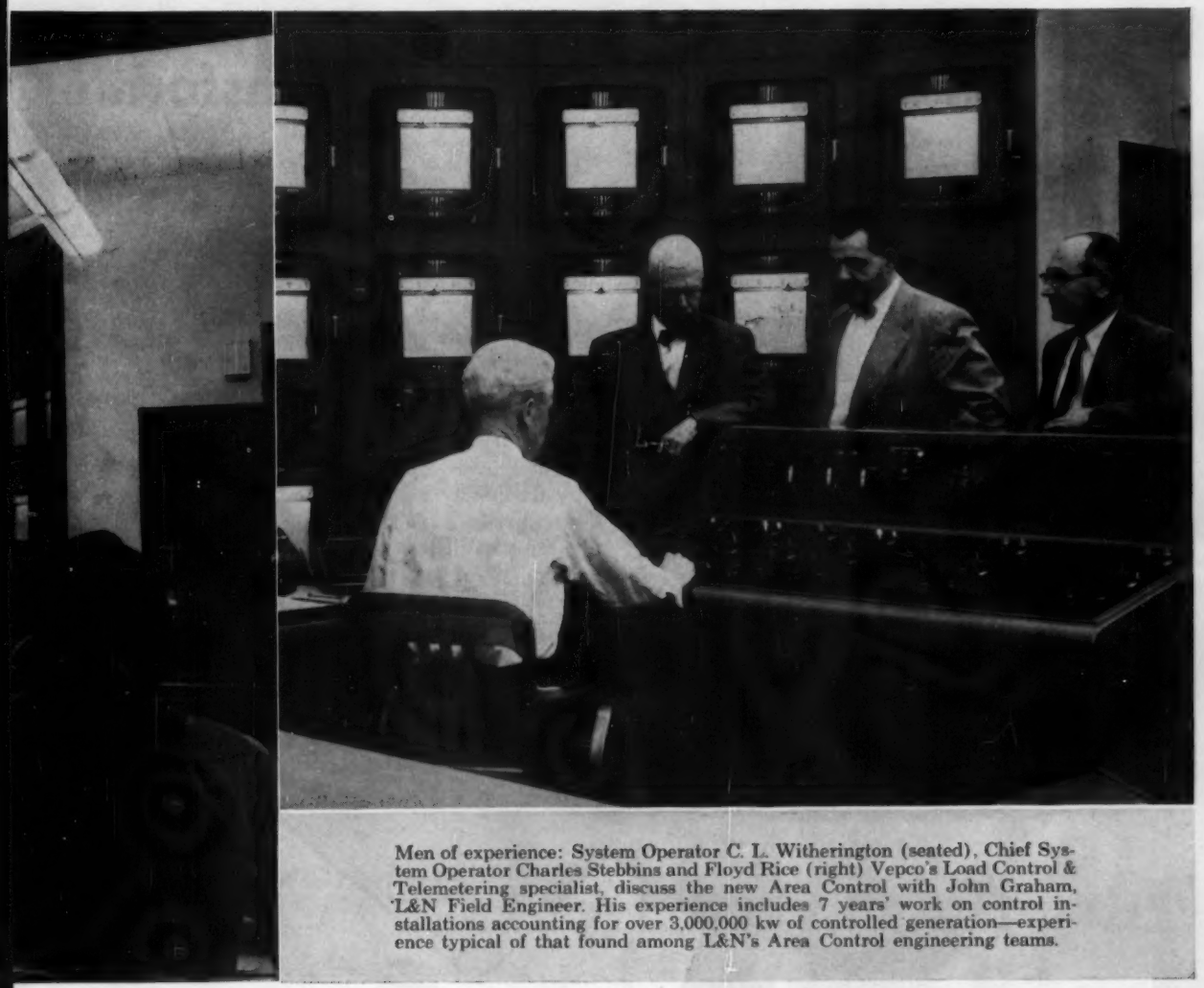


Virginia Electric & Power Co.

This progressive utility is one of many which are waging a push-button war on rising operating costs with the new Leeds & Northrup Area Load Control. Already, this new control has been installed on systems having a combined capacity of 40-*million* kw . . . about one-third of American generation, exclusive of industrial power. Actual performance shows that the new Area Control:

1. Provides full-time regulation. Under normal conditions, for example, 18 generating units in Vepco's service area are held on an economy loading schedule. When an operating upset occurs, the new control senses the upset and automatically initiates control action to aid the problem. When conditions return to normal, the control nudges units back to their lowest-cost-of-generation assignments. Result: the Vepco System Operator has automatic control when he needs it most. Savings? Although the answer depends on the characteristics of your system, may we suggest you discuss this point with your power neighbors who use L&N Area Control.

2. Permits smoothly integrated operation with your power neighbors . . . enhances fullest utilization of economy interchange. Vepco finds that their control contributes to a mutually beneficial "co-operating" relationship with the utilities surrounding their operating area. Control is particularly helpful in maintaining interchange schedules with two companies to which they are "tied" directly.



Men of experience: System Operator C. L. Witherington (seated), Chief System Operator Charles Stebbins and Floyd Rice (right) Vepco's Load Control & Telemetering specialist, discuss the new Area Control with John Graham, L&N Field Engineer. His experience includes 7 years' work on control installations accounting for over 3,000,000 kw of controlled generation—experience typical of that found among L&N's Area Control engineering teams.

joins 40-million kw trend to new automatic area control

3. Gives a complete answer to the dispatching problem. From his custom-engineered Area Control Console, the Vepco System Operator sees a complete panorama of centralized system operating data as it unfolds on precision Speedomax Recorders and Telemeters. Included are graphic presentations of the behavior of all 5 foreign ties and the output of 8 generating stations. Like all L&N Area Load Control systems, this one is designed to integrate with an L&N computer, when Vepco operations require.

The L&N men who stand behind this advanced control are load-frequency control career specialists who have solved many problems similar to yours. The same is true of the L&N engineering teams that translate your requirements into equipment.

Talk with these men about your operating cost problem. Let them show you why the modern L&N approach is so widely acclaimed—and what it can do for you. Contact our nearest District Office, or 4938 Stenton Avenue, Phila. 44, Pa.

Only Westinghouse offers you the transformer

with a PRE-TESTED LIFE!

Here's a transformer that can actually help you program your equipment investment thirty years from now—today. How? Through a revolutionary new concept of accelerated life testing, Westinghouse has pre-tested transformer life. Thirty years of equipment service has been telescoped into three.

Entire transformers from the production line have been put through literally thousands of cycles of overload up to 450% of rating, under closely simulated service conditions. Masses of data used to set up this unique program of testing include representative ambients as well as abnormal currents and voltages such as lightning and switching surges. Here is exhaustive evidence of durability of materials, uniform strength of windings, capability of whole insulation systems. Here is foolproof evidence of the soundness of Westinghouse transformer design . . . evidence that test-tube testing can't match.

The new Westinghouse Type S and CSP® transformer developments are based on the soundness of this design. Overload capability for all transformers has now been increased 20%, *without sacrifice in normal service life*. You get transformer capability tied more closely to modern load demands . . . a greater margin for peak. For the CSP transformer . . . fewer trip-outs, more time to make change-outs.

Are these transformers at these ratings proved on the line? 10,412 uprated Westinghouse transformers have operated successfully up to three years throughout the systems of utilities in New York, Missouri, Texas.

So here is double proof of performance of Westinghouse transformers. You don't have to gamble.

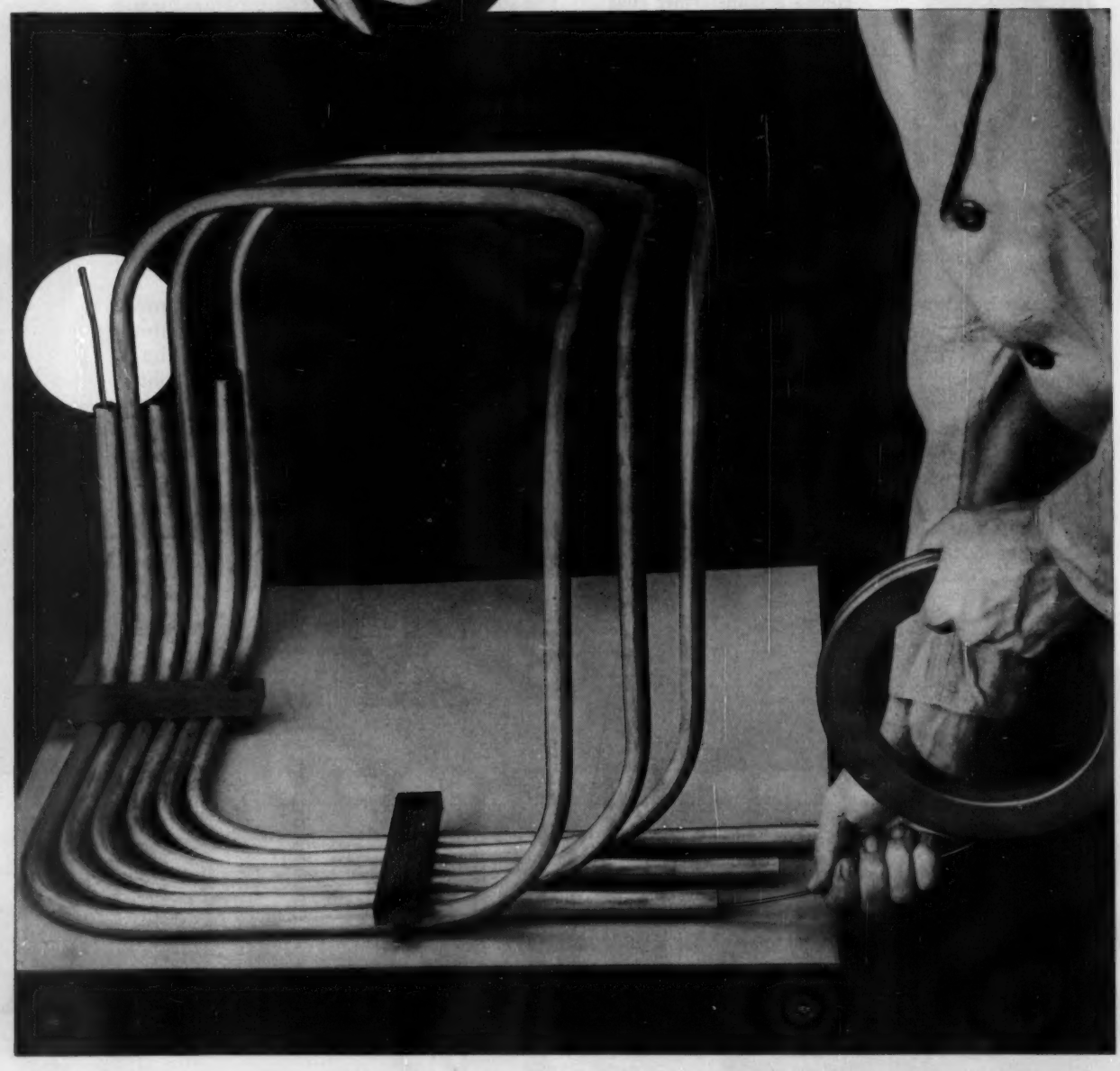
See your Westinghouse sales engineer, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-70782-X

YOU CAN BE SURE... IF IT'S

Westinghouse

"Time and temperature tests on insulation or wire by themselves just aren't the answer," says A. M. Lockie, design engineer, who has developed exclusive, new life testing of distribution transformers. Life-testing procedures at Westinghouse are based on experience obtained from subjecting transformers to 2200 overloads, 30 short circuits at 15 times rated current, a series of impulse, dielectric and induced potential tests, and daily load cycles up to 450% of rating.

New Rome EMT



Fish-Tape Slips Right Through Rome EMT. No amount of forcing would get a ⅛-inch fish tape through two competitive lengths (behind Rome EMT). Here the same tape is shown as it slides right past all eight 90-degree bends in the Rome EMT.

proved best in fish-tape test

Actual comparison test proves Rome EMT easiest to fish

In recent tests, Rome Cable's EMT came out first in fishability. Disinterested observers checked the results with X-ray photos.

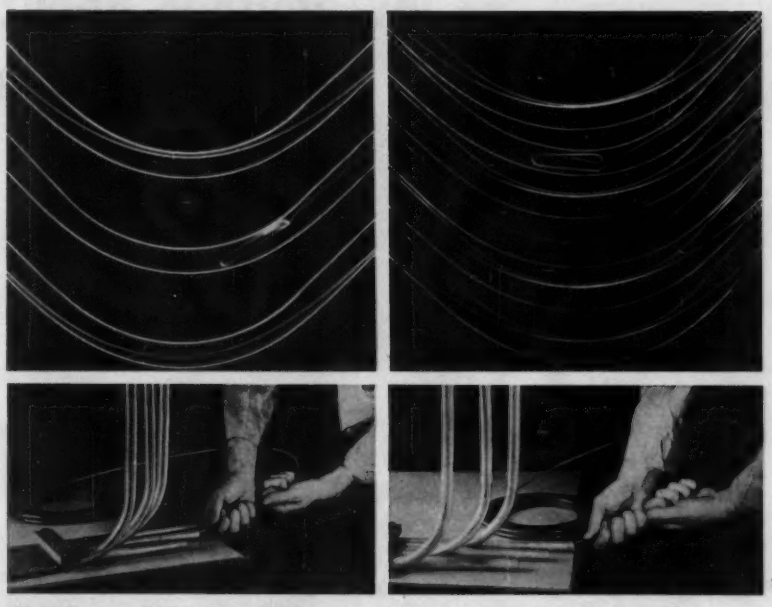
How the test was conducted:
Disregarding the National Electrical Code's limit of four bends, technicians bent a whole series of ten-foot lengths of ½-inch EMT into identical eight-turn runs for testing purposes.

A standard ⅛-inch fish tape was then run into the test samples. It went easily through all eight bends in Rome EMT. In every competitive sample, the tape stuck fast at one of the bends!

Why Rome EMT is easiest to fish
A shiny new interior lets fish tapes slide through with an absolute minimum of resistance. Careful baking—under rigid control—puts a uniformly smooth enamel finish inside Rome EMT.

Test it yourself
Pick *any* competitive EMT, bend it identically with a length of Rome EMT, and then try the fish-tape test. You'll find that Rome Cable wins every time in this test of direct comparison.

Specify Rome EMT for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 902, Rome Cable Corporation, Rome, N. Y.



Manufacturer "A" A ⅛-inch fish tape is being forced into this competitor's EMT. The X-ray photo (top) shows how the tape stuck fast on the fourth bend—as a result of a high-friction inside finish.

Manufacturer "B" The same fish tape is being run into another competitor's EMT. The X-ray photo shows the tape—stuck here on the seventh bend. Inside surface resistance caused this tape to stick.

Disinterested Observers from the Anstice Co., Inc., Rochester, N. Y., take X-ray photographs during tests. The photographing was witnessed by Chester Uffelman, Notary Public.

STOCK DISTRIBUTION CENTERS

Atlanta, Ga.
Chicago, Ill.
Dallas, Texas
Denver, Colo.
Houston, Texas
Kansas City, Mo.
Los Angeles, Calif.
Rome, N. Y.
Salt Lake City, Utah
San Francisco, Calif.
Seattle, Wash.
St. Paul, Minn.
Torrance, Calif.

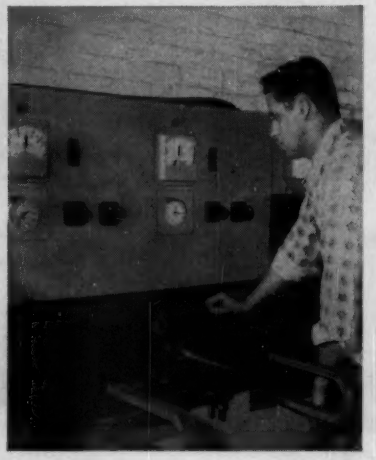
ROME CABLE
CORPORATION

"CORDON" CIRCUIT BREAKERS

Widely accepted for high fault protection on low voltage applications

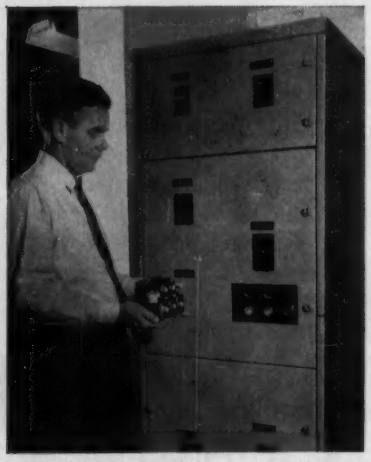
. . . 4 frame sizes available for immediate delivery

Conceived and engineered at I-T-E. Recognizing the need for a practical and economical means to adequately protect low-voltage distribution circuits where very high fault currents are encountered, I-T-E engineers conceived and developed the first completely integrated current-limiting molded case circuit breaker. Named the "Cordon", this compact circuit breaker has an interrupting rating of 100,000 rms amperes.



Manufactured and tested by I-T-E. The "Cordon" combines all the design and operating advantages of standard I-T-E molded case circuit breakers with the proven high interrupting ability of current limiting Amp-Traps.* A prototype of this was developed, tested and retested until it met the rigid I-T-E standards. Then, and only then, was a complete line offered to industry. Four frame sizes are now available.

*Amp-Trap: T.M. Reg. The Chase-Shawmut Co.



Widespread acceptance. Now thousands of delivered "Cordon" circuit breakers prove industries' acceptance of this device and confirm I-T-E's belief in the need for it. More and more "Cordon" circuit breakers are being specified as the practical, economical answer for low voltage, high fault applications.

Learn more about this new concept in circuit protection. Contact the I-T-E sales office nearest you, or write for Bulletin 5042A.

I-T-E CIRCUIT BREAKER COMPANY • Small Air Circuit Breaker Division

19th & Hamilton Sts., Philadelphia 30, Pa.

225 amp CK frame

400 amp CKL frame

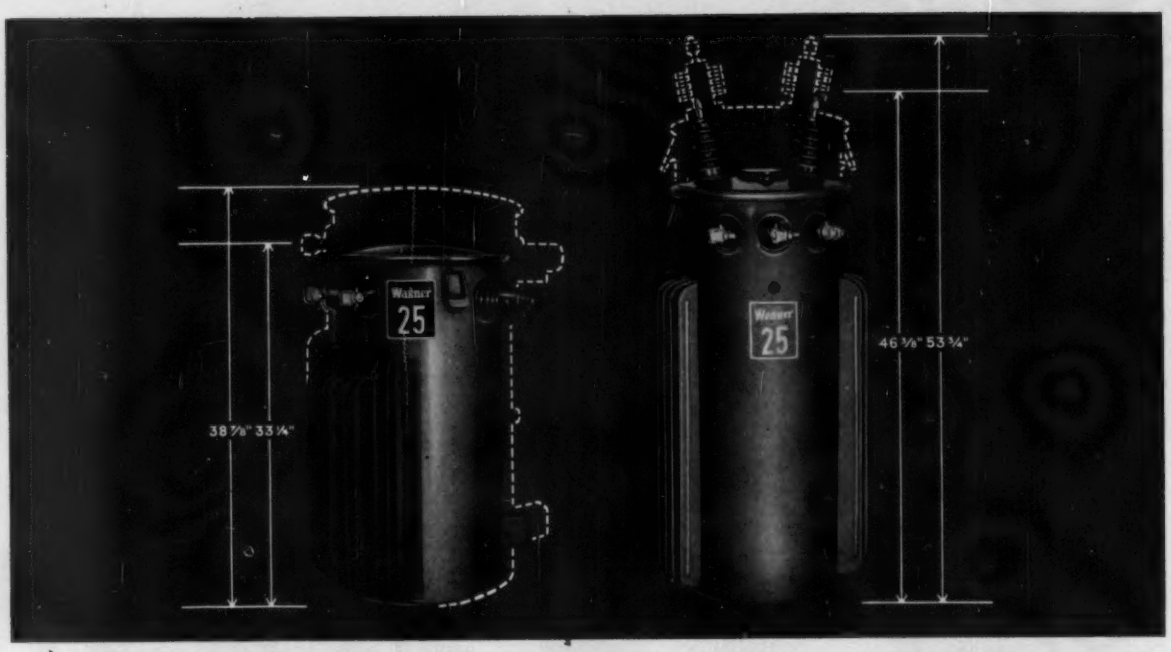
600 amp CL frame

100 amp CF frame

Engineers are now specifying these I-T-E Current-Limiting "Cordon" Circuit Breakers.

Immediate delivery can be made on all four frame sizes, for 600 v a-c and 250 v d-c service, 15 to 600 amperes.

I-T-E



WAGNER DISTRIBUTION TRANSFORMERS

smaller-lighter-easier to handle and install

Now Wagner Form W Distribution Transformers are substantially smaller and lighter than ever before . . . up to 25% shorter in the important overall height dimension—17% lighter in weight. Yet they are liberally designed for excellent electrical performance.

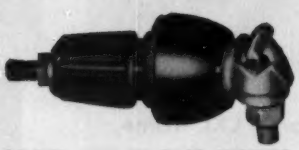
This means greater ease of handling—speedier installation. It also means that you can save money by putting greater transformer capacity on your existing structures . . . handle heavier loads without installing new poles. All these new Form W Transformers, in ratings 15 through 167 Kva, 15 KV and below, can be pole mounted.

Such reductions in size and weight are made possible by improvements in core and coil construction. A special resin coated insulating material is used for layer, channel and barrier insulation. Heat treating bonds this insulation to the coil conductors to give the coils exceptionally high mechanical and electrical strength.

These new, lighter shorter Form W Transformers will meet your distribution requirements. Consult the Wagner Sales Engineer in your area for complete information.

HIGH VOLTAGE SIDEWALL BUSHING

For use with either copper or aluminum conductor . . . safety-designed for faster, easier connections, without tools. Porcelain and terminal are locked in position.



LOCKED LOW VOLTAGE BUSHING

The bushing and terminal are key-locked to prevent rotation . . . no loose terminal connections to cause internal shorts. Suitable for copper or aluminum conductor.

SHUR-SEAL CLAMPING RING

Keeps transformers sealed air-tight . . . no atmospheric moisture or dust particles can get inside.

INHIBITED OIL—reduces oxidation to a minimum . . . retards formation of acids and sludge.

Wagner Electric Corporation

6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

T56-14

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS-AIR AND HYDRAULIC

NEWS-SCOPE

FUTURE NEWS ▶ **Group of Midwestern utilities have pretty well settled on a nuclear plant** design; are now in process of choosing a location. For roundup of other a-plants in the making see page 60.

Electric companies will have to raise about $2 billion from new securities to finance this year's $3.8 billion expansion program. By year end electric company plant will total some $40 billion—up from $36.5 billion at the end of 1956. Revenues will hit $8.15 billion compared with $7.5 billion last year.

Iowa legislature will consider another bill for regulation of utilities during the current session.

LATE NEWS ▶ **Lighting of a continuous 53-mile stretch of the Connecticut turnpike** has been approved by the State Highway Department. Cost will be around $2.6 million for initial installation. Mercury vapor luminaires will be used.

New York City Council approves modernized wiring code boosting feeder capacity requirements for all types of new buildings.

Massachusetts and New Hampshire withdraw their request for FPC to allocate a portion of St. Lawrence power to them. The states had protested that New York State Power Authority had declined to allocate shares of power to them.

The Joint Atomic Energy Committee is expected to begin hearings on the progress of civilian atomic power development about Feb. 18th.

Power bills re-introduced in Congress include one to provide federal construction of the Hells Canyon development, one to provide state construction of the Niagara re-development project and give preference in sale of power to public bodies and co-operatives, and one to authorize a $400 million federal nuclear reactor program. All were killed or passed over in the previous session.

Three of the first experimental gas filled (SF_6) power circuit breakers have been installed at Gulf Power Co's Pace substation to obtain performance data. The 115-kv, 1000-Mva units are made by Westinghouse Electric Corp . . . **In a major reorganization** at its East Pittsburgh plant, Westinghouse has converted the four plant divisions (power apparatus, switchgear apparatus, printing and publications, and feeder and service) into 10 basic product departments. The plant now becomes the firm's East Pittsburgh Division and continues to be headed by L. B. McCully, vice president and general manager of the plant.

Britain's new minister of power, Sir Percy Mills, may soon announce plans for considerable expansion in the nation's nuclear power program. Expansion would include construction by 1965 of 16 to 19 atomic power plants at cost of between $1.7 and $1.9 billion. Their capacity would be between 6,000 and 7,500 Mw.

Winner of Eta Kappa Nu's Outstanding Young Electrical Engineer Award of 1956 is Dr J. J. Baruch, vice president-treasurer, Bolt, Beranek & Newman. Honorable mention went to R. B. Seidel, president, Automatic Temperature Control.

Union Rural Electric Association may contest a public utility certificate it recently received from Colorado PUC on grounds that it does not provide exclusive rights to serve a prescribed territory.

ELECTRICAL WEEK

A TWO-MINUTE

ELECTRIC HEATING ▶ **Electrical World's exclusive heating survey discloses:** 25,000 to 30,000 additional home heating customers will come on utility lines this year; 2,500 new commercial heating customers will be added; included in these are 12,000 new heat pump jobs doubling present installations of these units; these additions will bring total electric space heating customers to 300,000 by the end of the year; public agencies and cooperatives will be serving two-thirds of these with electric companies serving the remainder.

There were some surprises in the survey results: Northern electric companies have about as many space heating customers as Southern companies, and the Northern companies anticipate faster gains in the field. Southern Nevada Power Co, with 30,000 customers, has 18,600 space heating installations. Utilities with winter peaks are pushing electric heating as hard or harder than those with summer peaks. Some 12½% of the companies promoting electric heating have lowest step rate of 2¢ per kwhr or more.

Complete survey results along with full account of Electrical World's recent electric heating and heat pump conference is wrapped up in special report (p. 71).

EVENTS ▶ **The nation's utilities will spend an average of $19 million every working day** this year for expansion of plant and facilities. That's the figure set in utility budgets. Roundup of recent construction announcements is carried in article (p 58).

System interconnections was main topic as private and public utilities in the eastern Missouri basin met to discuss studies by 12 electric companies on the need for unification and to get reports on federal development in the region (p 62).

WASHINGTON ▶ **Eisenhower Administration asks 11% increase in federal power** expenditures for fiscal year beginning July 1. Bulk of increase would go for TVA steam plant construction for which $77.9 million is budgeted as compared with $54.2 million during current year. Bureau of Reclamation multipurpose projects are slated for a $17 million increase over current year (p 56) . . . AEC lifts some of secrecy surrounding license applications for nuclear reactors (p 57).

ATOMIC PROGRESS ▶ **Electric companies step up nuclear power development.** EW survey discloses three and possibly four additional electric company groups are seriously considering specific projects. Smaller reactors in 30-60-Mw range are possibilities. One group is considering a large, heavy-water plant. Around 50 companies make up the active groups (p 61).

GENERATION ▶ **Centralized control for a medium-sized steam plant will pay for itself in five** years, writes Design Engineer H. T. Jurewitz, Southern California Edison Co. He tells how his company converted the 288-Mw Redondo Plant to centralized control for $1 million in slightly more than a year's time. Results: Reassignment of 28 operators, all badly needed elsewhere; a significant cut in cost per kwhr; and a present complement of six men per shift for the four 72-Mw units and seven boilers (p 64).

Water-cooled stator winding is new design feature for a 30-Mw generator being installed in Britain. Water flowing through the winding keeps temperature rise down to 2.2C compared with 65C rise for stator conductor of conventional unit (p 89) . . . Rubber coating takes place of expensive welding job to prevent leaks in penstock (p 92).

SUMMARY OF THIS WEEK'S ELECTRICAL WORLD

TRANSMISSION ▶ **Wood H-frames for a 230-kv line saved material and labor costs** for New York State E&G Corp. The 35-mi circuit is 795-MCM ACSR suitable from radio influence and corona loss standpoint for 230-kv operation. Rugged mechanical design was proved in full-scale structure tests which justified use of special hardware at some joints (p 68).

DISTRIBUTION ▶ **Distribution men must guard themselves against decayed or damaged poles,** warns REA. Collasping poles caused two deaths and six serious injuries last year. Beware of those that have hollow or "punky" sound near ground line (p 94) . . . Feather-weight "talkie" radio helps foreman of Lorain Media Rural Electric Co-op direct line crews on conductor stringing jobs (p 94).

METERING ▶ **Let's standardize on a couple of types of polyphase watthour meters** and cut obsolescence losses brought about by rising customer loads. That's the gist of an article by W. H. Farrington, staff meter engineer, Texas Electric Service Co. And what's more, Farrington has helped develop two universal meters that will measure loads carried by service connections ranging from 2-wire, 120-v, right up to 4-wire, 3-phase wye, 277/480 v. One is a self-contained 25-amp polyphase meter. The other is for current transformer connections (p 66).

SELLING ▶ **Fleet of fully-equipped appliance service trucks patrol area** served by Indianapolis P&L. These specially-designed, van-type vehicles carry parts, tools, and other facilities for repairing ranges, water heaters, and commercial cooking equipment. These trucks have enabled repairmen to take care of 95% of the water heater calls with one-stop service (p 96).

MANAGEMENT ▶ **Money is available—at a price.** Utilities offering securities during the first few weeks of this year find the axiom holds true in today's tight money market. But despite the price, utilities are keeping to previously announced financing schedules . . . Niagara Mohawk offers $46.2 million, 4⅝% debentures due 1970 on negotiated rather than competitive basis with approval of New York PSC . . . New FPC Uniform Systems of Accounts booklet is available (p 131).

PEOPLE ▶ **Delaware Power & Light names two vice presidents:** R. B. Richardson for operations and Fred T. Bear for engineering. Both move up from assistant VP posts (p 124).

MANUFACTURERS ▶ **Kaiser Aluminum & Chemical Corp buys** the wire and cable business of United States Rubber Co. U. S. Rubber's utility customers will continue to be served through same sales and distribution channels . . . An electrical-conductive silicone rubber is now available (p 123) . . . Irrathene irradiated polyetlylene, an insulating material, is being moved from pilot plant to commercial production (p 123).

NEW EQUIPMENT ▶ **New 75-Mva, 1,200-amp magne-blast power circuit breaker is available** with light duty 4.16-kv metal-clad switchgear. Reported to provide full interrupting capacity in five cycles or less, it is said to allow a 50% increase over existing 4.16-kv, 50-Mva metal-clad switchgear with same space requirements. . . Recent addition to a line of watthour meters is one measuring loads up to 200-amp. It features arc-resistant insulation in the electromagnet, self-contained arc gaps to by-pass electrical disturbances, newest magnets to resist calibration changes, and microset adjustments—all accessible from front of meter (p 102).

ENGINEERING TRENDS

Construction cost indices hit new highs in January, according to Engineering News-Record. Contributing to these peaks are cement price increases in 12 cities, lumber hikes in three, and wage raises in six of the 20 cities sampled for the index series.

Electronic computers control production of steel for Jones & Laughlin's new roughing mill at Aliquippa, Pa. Control equipment is of the card-program type and cost $1½ million, reports Electronics in its Jan. issue. Another computer controls the exact amounts of sugar, flour, and other ingredients fed to 16 mixers at National Biscuit Co's new $15-million Philadelphia bakery.

Non-classified results of government-financed research are made available to American industry in growing volume by Office of Technical Services, U. S. Dept. of Commerce. Government research, estimated at the $2.7-billion level this year, represents about half the nation's total research and development and includes many items of immediate interest to industrial plants and laboratories.

Monitors in nuclear reactor plants near the demineralizers normally give accurate and early indications of fuel element failure or unusual corrosion because demineralizer resins accumulate radioactivity.

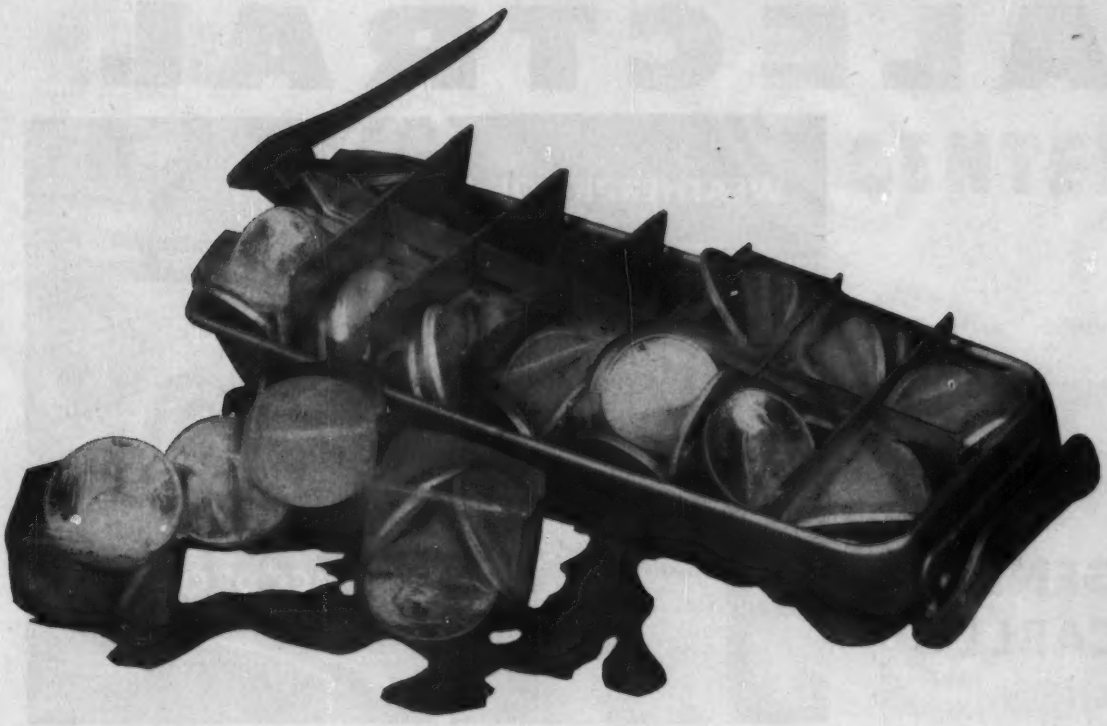
Twisted joints in aluminum wire can be welded by gripping twist with pliers connected to one terminal of a 12-v battery and touching the top of the twist with a carbon rod connected to the other battery terminal.

Twin 1.25-in. conductors cause less RI at 400 kv than one 1.75-in. conductor at 350 kv. A single conductor to match the twin 1.25-in. bundle would have to exceed 2-in. diam. At 350 kv twin 795-MCM and triple 397.5-MCM conductors are comparable to a single 1.75-in. conductor, and the triple bundle has only 1,192.5-MCM area against 1,414 MCM for the single.

FROM EDITORS IN THE FIELD

Numbered metal tags attached to oil circuit breakers and tank lifters for identification and office records enables a crew to select the proper tank lifter before it starts out for an oil-circuit-breaker maintenance job. This means of identification was adopted by Los Angeles Dept of Water & Power after an inventory of all breakers was made and analyzed for the tank lifters required. The survey disclosed that about 50 different lifters were needed for breakers in the 2.4-to-34.5-kv range and that actual field measurements had often been made in the past to select the proper lifter, followed by a trip to the central tool room to get it.

Savings of $1,500 in postage rewarded Union Electric Co's cut of $\frac{1}{16}$ in. from the size of a brochure mailed to stockholders. This negligible cut clipped 3 cents off the postage required for each of 50,000 units.



Bushing standards will keep a lot of your dollars out of the "deep-freeze"

Here is how to keep some large sums of invested—and inactive—capital out of the "deep-freeze."

Industry standards are now in effect for bushings in the 23-69-kv range. We are on the threshold of expansion of this activity into the high voltages.

Standard bushings can be completely interchangeable among different station apparatus. A minimum stock of spare standard bushings could provide emergency protection for both present and future equipment. Because modern bushings are designed with reduced diameters, they will usually fit older apparatus as well, with simple adaptations, thus greatly extending the stand-by effectiveness afforded by spare units, and multiplying their economy.

Under the ASA industry program of bushing standards, you need no longer purchase elaborate stocks of special spare bushings that tie-up sizeable blocks of capital in what amounts to a frozen inventory. This is why we say, "Bushing standards will keep a lot of your dollars out of the deep-freeze."

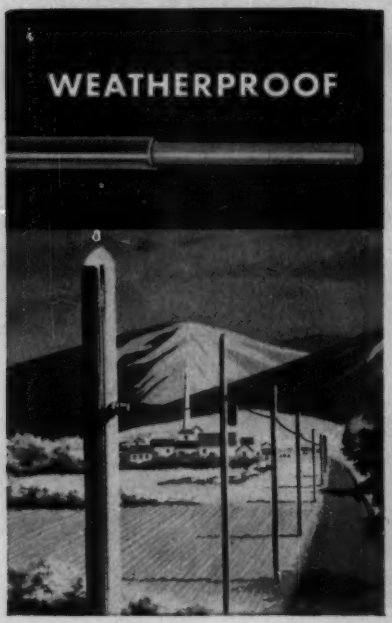
But, remember this—standards relate only to dimensional and electrical characteristics. They don't control a man's knowledge of his business, nor do they control his desire or ability to make a superlative product. In the new O-B bushing, 40 years of experience and fine reputation have been combined with long research and product development, with the very best of new manufacturing facilities, with the industry's leading laboratory, all to produce a bushing of high performance and durability—a bushing that will merit your specification.

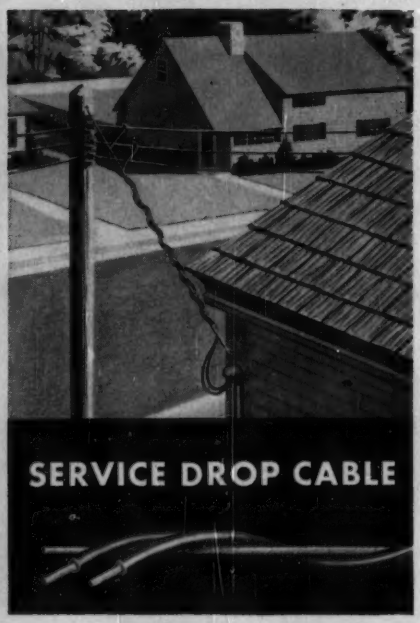
OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

4649-H

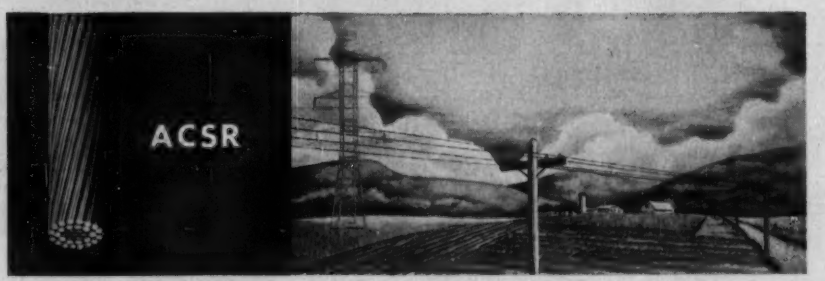
ALECTRAL





GENERAL CABLE'S

ALUMINUM CONDUCTOR



Built into its aluminum products are 75 years of General Cable's engineering and manufacturing experience. In this record are more than 25 years of successful performance of insulated aluminum conductors marketed as ALECTRAL. Available in ALL-ALUMINUM, ACSR, WEATHERPROOF and with RUBBER and THERMOPLASTIC insulations. A sound and economical investment for all voltage ranges.

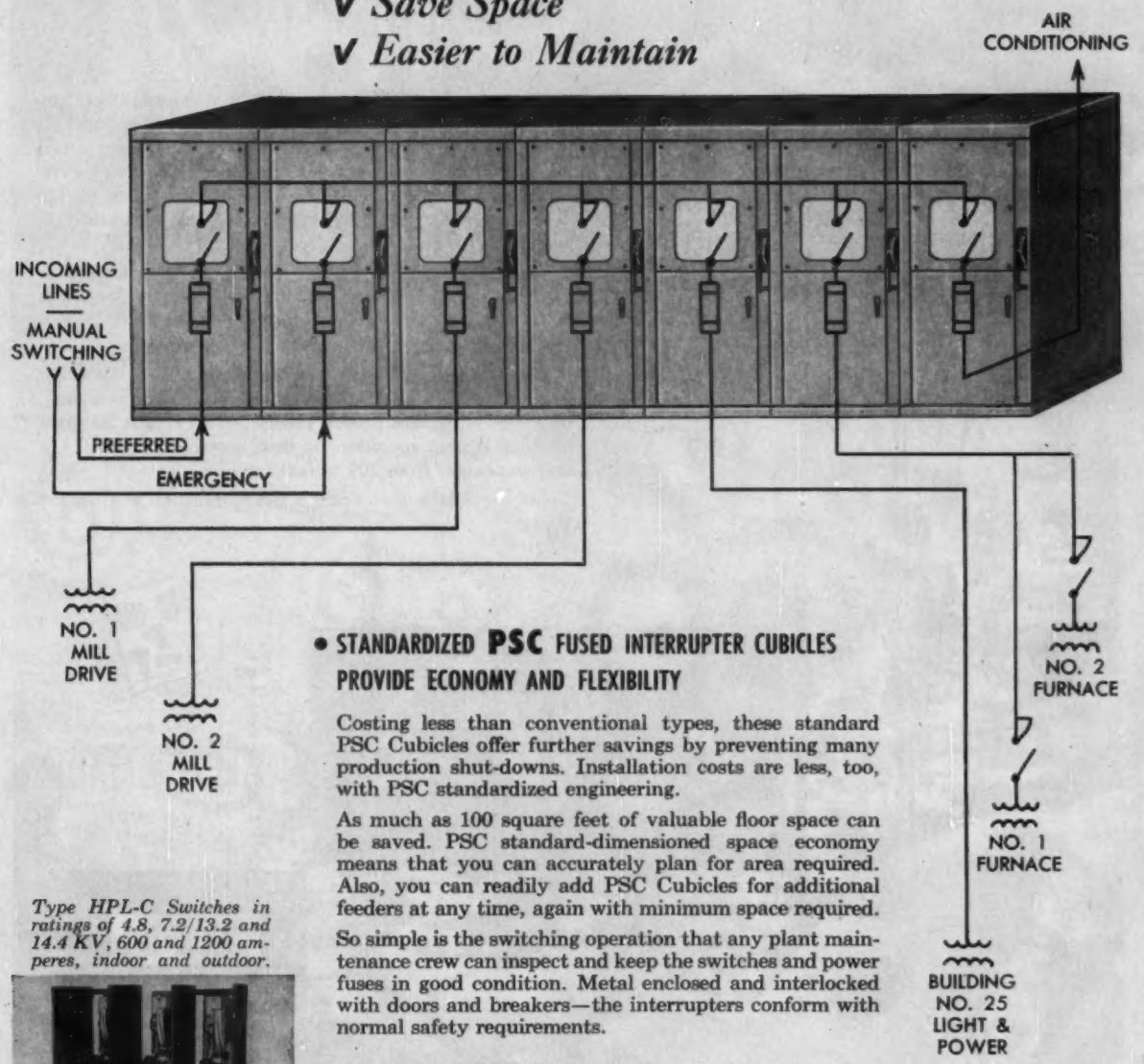
GENERAL CABLE CORPORATION, 420 Lexington Avenue, New York 17, N. Y.
Offices and Distribution Centers Coast-to-Coast

for quality and service . . . **specify GENERAL CABLE**

R&IE

POWER SWITCHING CENTERS

✓ Cost Less
✓ Save Space
✓ Easier to Maintain



• STANDARDIZED PSC FUSED INTERRUPTER CUBICLES PROVIDE ECONOMY AND FLEXIBILITY

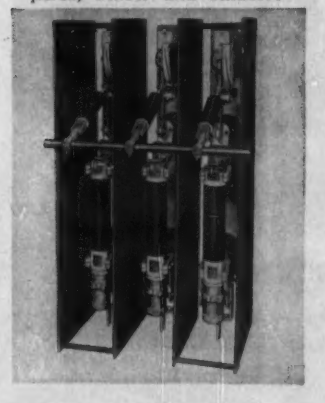
Costing less than conventional types, these standard PSC Cubicles offer further savings by preventing many production shut-downs. Installation costs are less, too, with PSC standardized engineering.

As much as 100 square feet of valuable floor space can be saved. PSC standard-dimensioned space economy means that you can accurately plan for area required. Also, you can readily add PSC Cubicles for additional feeders at any time, again with minimum space required.

So simple is the switching operation that any plant maintenance crew can inspect and keep the switches and power fuses in good condition. Metal enclosed and interlocked with doors and breakers—the interrupters conform with normal safety requirements.

• *Ask the R&IE Representative to show you these economies with PSC Cubicles*

Type HPL-C Switches in ratings of 4.8, 7.2/13.2 and 14.4 KV, 600 and 1200 amperes, indoor and outdoor.



R&IE

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

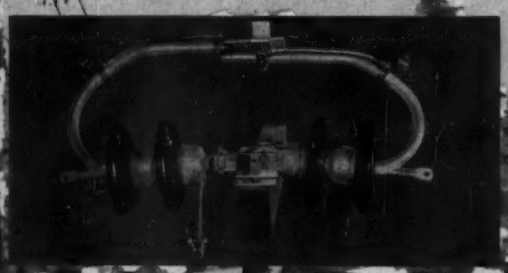
KPF switches operate smoothly, surely in all weather!

What's *your* weather? Arctic cold? Tropical rain? Parching desert sun? KPF switches operate unfailingly under all conditions. Their exclusive mechanical design permits a slight amount of movement before opening the switch so even extreme ice formations can be cracked off easily. Warpage cannot jam the switch, and lack of lubrication is never a problem.

KPF phase units consist of two rigid dead-end assemblies with rigid jumpers forming the switch arms. One is stationary, the other rotates to make or break the circuit. There's no delicate, complex mechanism to malfunction.

Their utmost design simplicity means KPF switches weigh less, install faster without extra bracing, need no servicing, cost less. They have proved themselves in almost 50 years of major system operation, on lines carrying 7.5 to 110 KV and amperages from 200 to 600 amperes.

Get the details, then order a test installation and see for yourself.



For catalog, complete specifications, write direct

KPF
AIR BREAK SWITCHES
Standard for nearly half a century

3619

KPF ELECTRIC COMPANY
1624 E. Alpine Avenue
Stockton 5, California
Dept. E

About the finer points of metering:

Sangamo J2 Meters ...safety-packed in re-useable cartons

Sangamo J2 Watthour Meters are shipped to you in re-useable cartons that are scientifically engineered to maintain accurate factory calibration of the meters during shipment. J2 Meters, which are shipped sealed, arrive ready for use. They can be put on your lines, as received, without adjustment. Meters are fully protected against damage by the "floating method" of packaging. No part of any meter touches the sides, top or bottom of the outer carton.

Many power companies re-use these sturdy cartons, again and again, on their line trucks. Specify Sangamo J2 Meters—calibrated, sealed, and packaged for unimpaired accuracy.

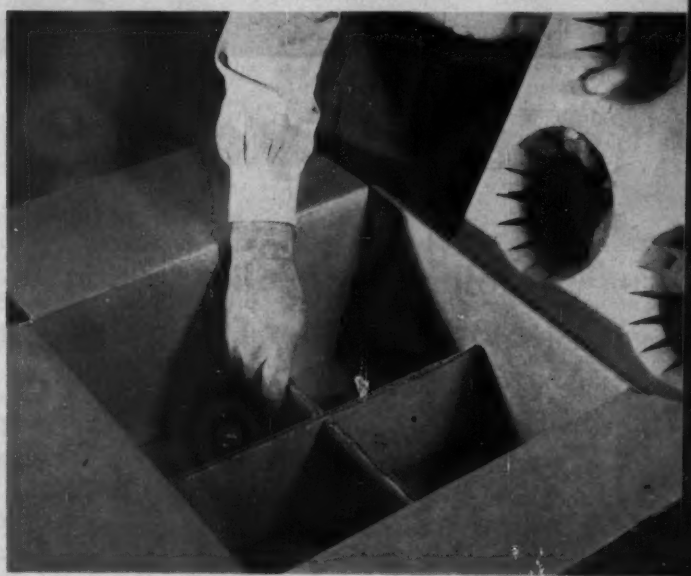
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

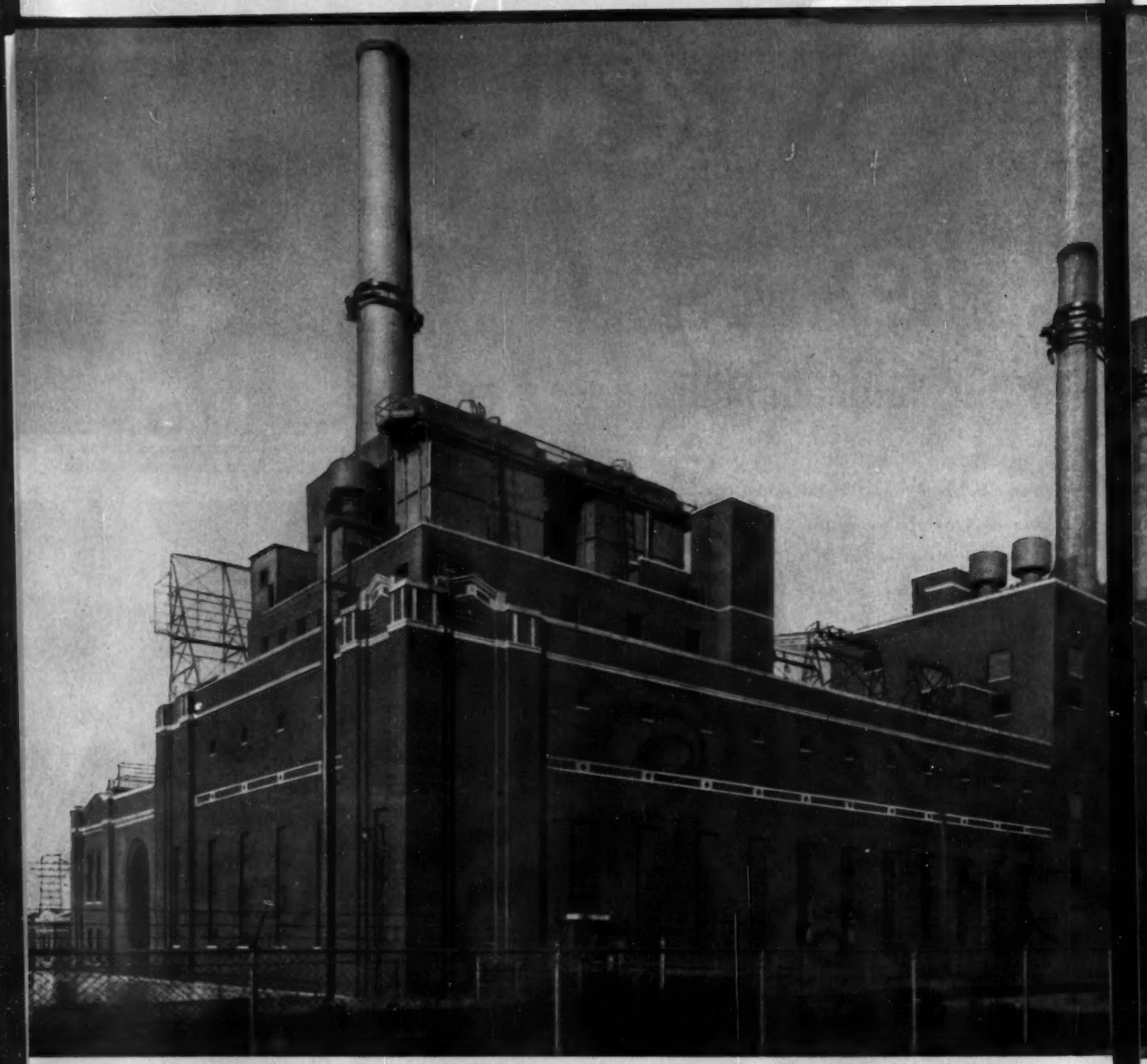
JM57-1

350 lb. test outer carton has double-protected top and bottom. Drop tests and shipping tests prove that the outer carton must be ruptured before meters can be damaged.

Specially designed die cut tray cradles meters in suspended position so that no part of glass covers touch the bottom or sides of case.



Cross brace partitions divide case into separate compartments for each meter and provide firm support for the die cut tray.



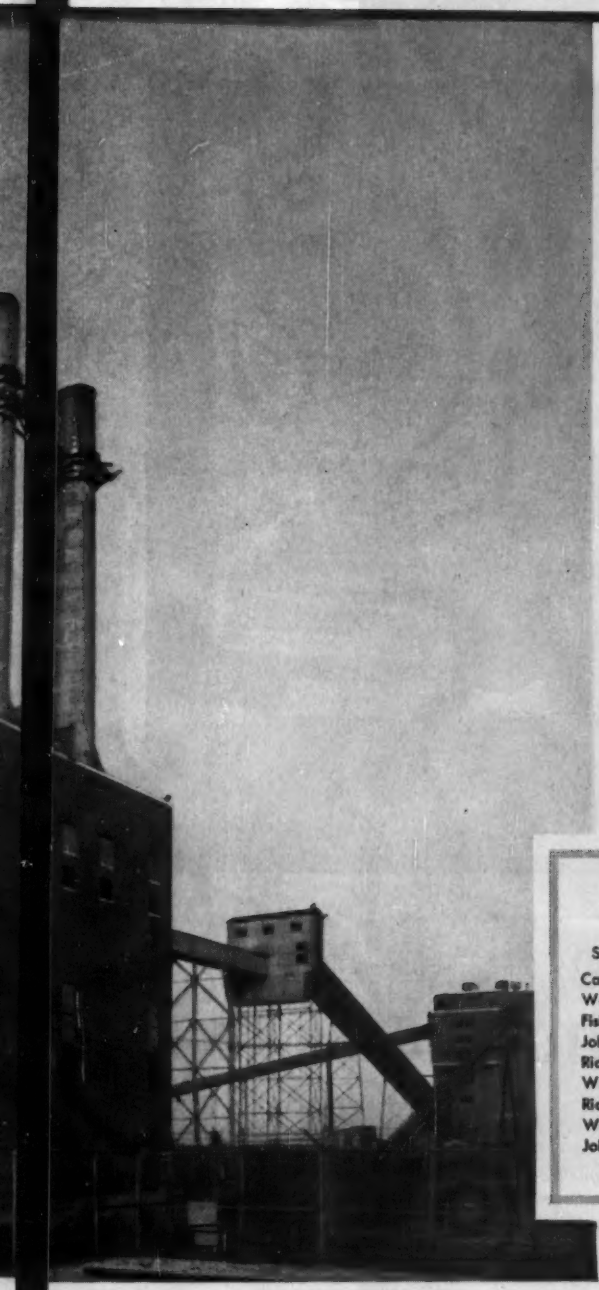
New Cyclone Furnace Unit

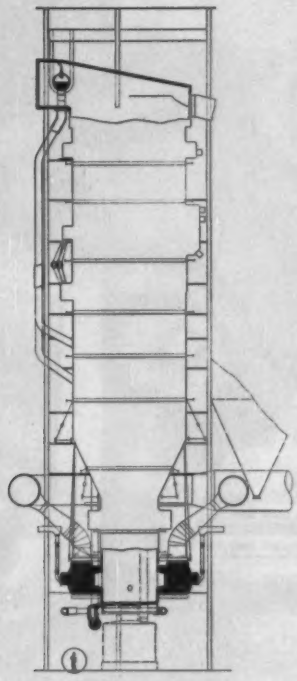
Installation at Joliet Station to Bring Higher Efficiency ... Lower Costs to Power Generation

Commonwealth Edison System's newest addition, at its Joliet Station, will be a B&W Radiant Reheat Boiler with Cyclone Furnaces. This is the 16th unit of this type the system has bought since 1944 and raises total system capacity served by Cyclone-fired units to over 1,600,000 kw.

Early in the development of the Cyclone Furnace by B&W, Commonwealth Edison recognized its potentialities for burning low-grade coals. The system's engineers and operators cooperated with B&W in the project, and, in September 1944, the

each meter and provide firm support for the die cut tray.





B&W RADIANT REHEAT BOILER WITH CYCLONE FURNACES, arranged for opposed firing, for Commonwealth Edison System's Joliet Station. Unit will deliver 2,200,000 pounds of steam per hour at 2100 psi with temperature of 1055 F, reheat to 1005 F. Boiler design is 2375 psi. Sargent & Lundy, Consulting Engineers.

CYCLONE FURNACE BOILER UNITS IN COMMONWEALTH EDISON SYSTEM

STATION	NO. OF BOILERS	NO. OF CYCLONES	TOTAL CAPACITY LB/HR	DESIGN PRESSURE	STEAM TEMP. F	REHEAT TEMP. F
Calumet	1	1	150,000	600	650	—
Waukegan	1	2	300,000	650	760	—
Fisk	2	8	1,500,000	1475	935	—
Joliet	2	6	1,200,000	1525	1010	—
Ridgeland	4	16	2,920,000	2125	1050	—
Waukegan	1	4	830,000	2050	1010	1010
Ridgeland	2	12	2,200,000	2125	1050	1000
Will County	2	10	2,400,000	2125	1050	1010
Joliet	1	9	2,200,000	2375	1055	1005
	16	68	13,700,000			

For Commonwealth Edison

first commercial application went on the line at Calumet Station. Historic Boiler Unit No. 20-A, like the new unit at Joliet, burns highly volatile Central Illinois coal with a high ash content and low ash-fusion temperature.

The Cyclone Furnace simplifies the entire process of coal preparation, combustion, ash segregation, and ash handling and effects savings in most of the elements of power generation costs.

In service or on order, 64 boilers with 220 Cyclone Furnaces throughout the country serve a total capacity of over 6,600,000 kw. They merit examination in connection with your next installation. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

G-820-CS

BABCOCK & WILCOX

BOILER DIVISION

THESE '57 CHEVIES TURNED THE TOUGH ALCAN HIGHWAY INTO A TURNPIKE!

They took the "teeth" out of North America's toughest truck run in an amazing display of stamina and dependability! The Chevrolet Alcan test called for great truck components . . . and here they are, the same modern features you'll get in *your* '57 Chevy!

Modern high-compression 6's—a time-proved Chevrolet truck Thriftmaster 6 made the tortuous Alcan Highway test look easy . . . registered a high 18.17 miles per gallon!

Short-stroke V8 power—with the shortest stroke of any truck V8's, new Chevy engines stand first in their field for efficient load-pulling! Their great performance in Alaska proved it.

Safe, sure brakes now Alcan proved—in light- and medium-duty models, Hydrovac power brakes* supplied up to 85% of the braking effort!

Unit-design cab and body construction—Chevrolet truck cabs and bodies remained tight and solid on Alcan bumps, showed that they're built to *last!*

Rugged Synchro-Mesh manual transmissions—they displayed never-say-die durability . . . came through with smooth, flexible, trouble-free performance!

*Easy-going Hydra-Matic transmission**—it reduced driver's work immeasurably and it saved wear on drive-line parts, too!

Sturdy frames and long-leaf springs—these brawny chassis components proved they can take it when the going is roughest . . . took the Alcan's worst with strength to spare!

These Alcan-proved Task-Force 57 features and others like them (such as extra-heavy rear axles, easy-rolling Ball-Gear steering, and new, improved tubeless tires) are ready to tame your tough truck runs too! Boost your hauling profits by seeing your Chevrolet dealer soon! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

**Optional at extra cost.*

1957 CHEVROLET TASK-FORCE TRUCKS

PROVED ON THE ALCAN HIGHWAY . . . CHAMPS OF EVERY WEIGHT CLASS! CHEVROLET

SECURITY OF YOUR TRANSMISSION LINES depends on reliability and long life of suspension insulator units. In its 40 years, Lapp has made millions of these discs, and never before have we offered so big a dollars-worth in uniformity of mechanical strength, electrical permanence—in assurance of long, trouble-free service on your lines.

STRONG SAND-BANDS make strong insulators. Compression glazing, in which Lapp pioneered, increases the strength of insulator porcelain about 50%. This advantage is largely lost, however, if sand-band areas do not develop the same compression. Lapp meets that problem with "compression sand." This "sand" is true porcelain, but made from a special body with lower coefficient of expansion than the insulator body. The result is that after firing, the fused-on sand-band goes into compression with respect to the insulator shell. Laboratory tests prove the over-all uniformity of Lapp suspension insulator strengths. So do service records on transmission lines the world over.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

Where CREEP is a problem . . .

TESTS PROVE 90% LESS CREEP IN TELLURIUM LEAD ALLOY SHEATHING ON ROEBLING PAPER POWER CABLE!

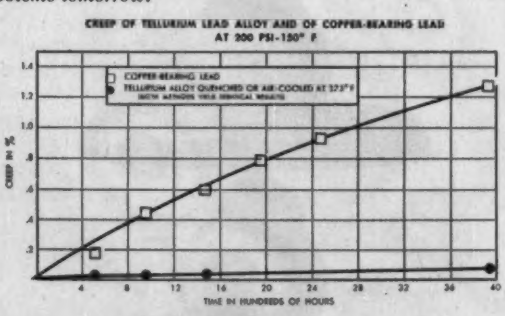
Roebling electrical wires and cables are available with either copper or aluminum conductors.

Only *one-tenth* the creep of ordinary cables—that's just one of the unusual properties of Roebling Tellurium Lead Alloy Sheathing on paper power cable, as shown by exhaustive creep tests in Roebling laboratories and by outside research. These impressive laboratory results are matched by field experience with thousands of feet of Roebling cable with Tellurium Lead Alloy Sheathing.

Look at the results on the graph yourself. You'll see that at 150° F Roebling Tellurium Lead Alloy Sheath stands up remarkably well, where copper-lead sheath, under the same conditions, stretches nearly 1.3% after only 4,000 hours at 200 psi.

Couple the unusual superiority of Tellurium Lead Alloy Sheath with the serviceable inner construction of Roebling Paper Power Cable—the uniform controlled-tension application of the paper tapes, for instance—and you have more than one reason why this cable is being specified by name, more and more, wherever power cable has to last a long, long time.

Write for full particulars today . . . rid yourself of cable problems tomorrow!

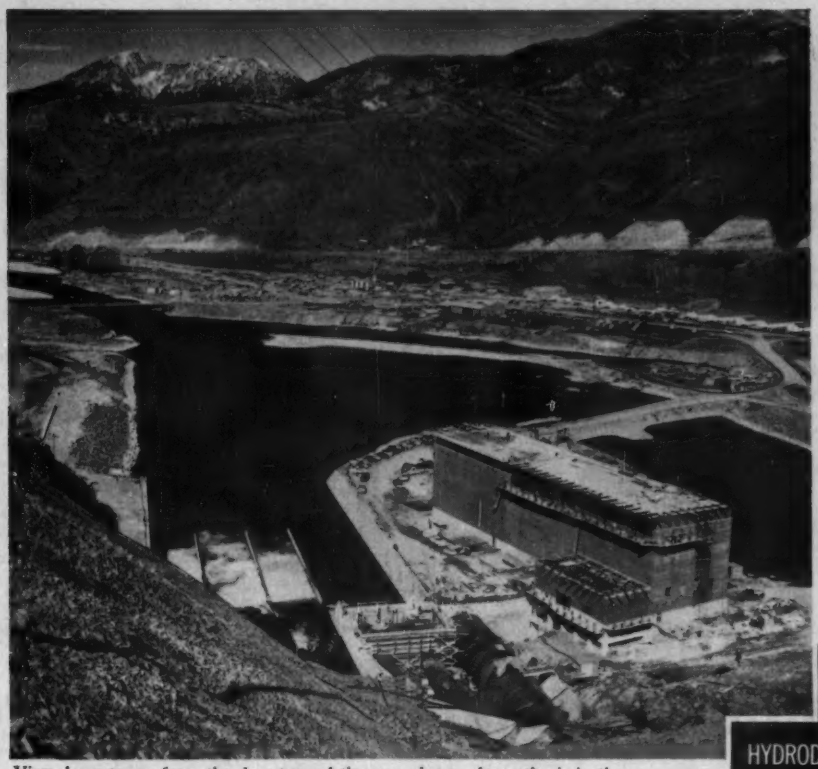


ROEBLING

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J.

Subsidiary of The Colorado Fuel & Iron Corporation

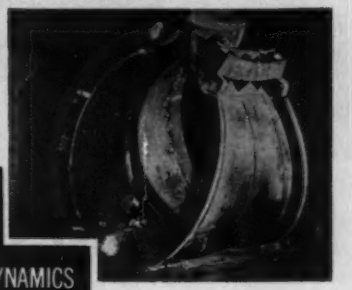
Branch Offices in Principal Cities



View downstream from the dam toward the powerhouse shows the irrigation bypass (left), penstock (center) and tail-race canal (right). *(U.S.B.R. photo)*

Final check assembly of Unit #2—a complete scroll case, pit liner, distributor gates and operating mechanism—is made in SMS shops prior to shipment to the site.

Welding a flange to a section of Unit #3's spiral steel case. SMS shops are completely equipped to fabricate weldments of the largest types.



HYDRODYNAMICS

MILE-HIGH SMS-FRANCIS TURBINES SOON TO DELIVER POWER AT PALISADES

High on the south fork of Idaho's Snake River, the first of four SMS-Francis turbines at Palisades Dam is scheduled to go on the line in 1956. The Palisades Dam, which is the Bureau of Reclamation's largest earth-filled dam, is primarily an irrigation project. The dam will have a crest length of 2,100 feet, rise 270 feet above the streambed, and provide a storage reservoir some 20 miles long and 3 miles wide.

Four vertical SMS-Francis turbines will be installed to produce a total capacity of 114,000 kw. Designed to operate at a site more than a mile above sea level, each unit is rated at 39,500 HP under a 190-foot head. The power generated will serve southeastern Idaho, where Atomic Energy Commission facilities and a growing phosphate industry now tax the existing electric supply.

Whatever your needs in hydraulic turbines and accessories may be, S. Morgan Smith offers 79 years' background in designing and manufacturing equipment for world-wide installation. This experience—over 16,000,000 HP installed capacity—is your greatest assurance of satisfactory equipment performance. For full information, write S. Morgan Smith Company, York, Penna., U.S.A.

HYDRAULIC TURBINES
PUMPS
GATES & HOISTS
TRASH RAKES
ACCESSORIES

HYDRODYNAMICS

ROTOVALVES
BALL VALVES
BUTTERFLY VALVES
FREE-DISCHARGE VALVES
CONTROLLABLE-PITCH SHIP PROPELLERS

SMS

S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

L-M transformers provide balanced performance which results in low losses. Extremely quiet operation is another advantage. L-M's new obround tank design, shown here, retains all outstanding Round-Wound performance characteristics.

How L-M's Round-Wound® Design Assures Consistently Low Losses, Greater Revenue

L-M's wound-core, round-coil construction provides the most efficient design for low losses, good regulation, greater revenue at all power factors.

By **R. W. HARTSOOK**
Chief Engineer
Small Distribution
Transformers
Line Material Company

One of the most important objectives in transformer design is to achieve a balance of low copper loss, low exciting current, and low core loss without sacrificing other desirable performance characteristics. The Round-Wound design has many inherent advantages that aid the designer in achieving this objective.

Round-Wound Design Offers Balanced Performance

L-M's Round-Wound transformer design consists of a wound core, with a cruciform cross section closely approximating a round form. Long round coils are wound directly onto the wound core. This construction gives L-M transformers inherent advantages to minimize losses and offer balanced performance.

Low Copper Loss

In the Round-Wound transformer, the core cross section is nearly round. As shown in Figure 4 at right, a round core has a much smaller perimeter than a rectangular core of the same cross-sectional area. Therefore the turns in a Round-Wound coil are shorter. (Figs. 2 and 3). With the same cross-section wire and the same number of turns, there is less total length of wire and less watts of copper loss.

In addition, the higher efficiency of the core-coil arrangement actually permits fewer turns. The combination of smaller turn diameters and fewer turns results in low reactance and impedance, giving the desirable regulation indicated by the curves in Figure 1.

High Overload Capacity

Low copper loss also contributes to better overload capacity, since copper loss watts increase as the square of the overload on a transformer. Therefore any reduction in copper loss results in a substantial increase in overload capacity. This is a bonus over the excellent overload capacity of the Round-Wound transformer resulting from its exceptionally good cooling characteristics.

Low Exciting Current, Low Core Loss

L-M's core is tightly wound of a continuous strip of oriented steel. Coils are wound directly onto this core by means of L-M's exclusive winding machine. Since the core is not cut, unwound, or disturbed in any way after annealing, there are no air gaps to break up the flux path. This construction results in low exciting current and high magnetic efficiency of the core.

Quiet Operation

L-M's wound-core construction eliminates all laps, flaps and gaps in the laminations. This contributes greatly to the extremely quiet operation of L-M's Round-Wound transformer.

Get Details on L-M's Round-Wound Transformers

Ask the L-M Field Engineer for complete information on L-M's Round-Wound design, and bulletins. Or write Line Material Company, Transformer Division, Zanesville, Ohio.

LINE MATERIAL
A McGRAW ELECTRIC COMPANY DIVISION

L-M's wound-core, round-coil construction provides exceptionally good cooling for high overload capacity and almost an ideal magnetic circuit to minimize losses.

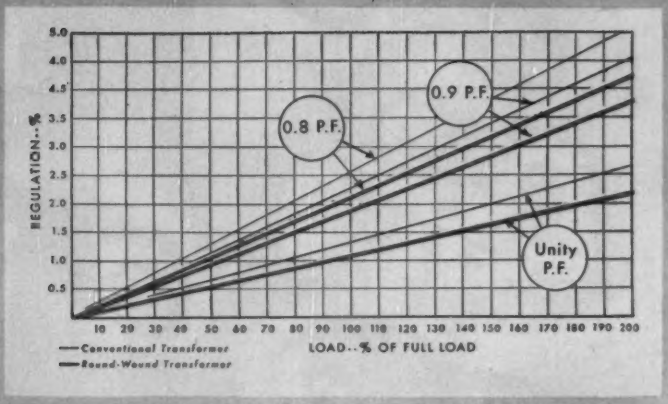


Fig. 1. Round-Wound offers good regulation at all power factors. Regulation of new 25 kva 2400-120/240 volt Round-Wound transformer compared with that of older design, showing effect of load and power factor on regulation. Multiply the difference in regulation by the number of old distribution transformers on your system, and see how much more revenue these modern L-M transformers produce.

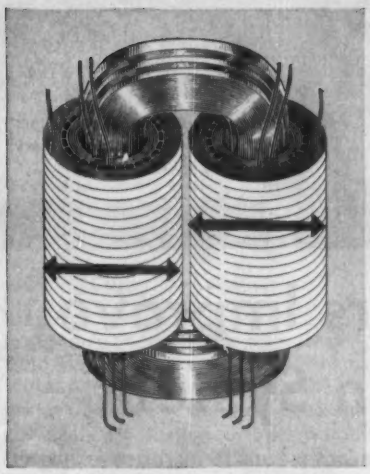


Figure 2. Round-Wound Design

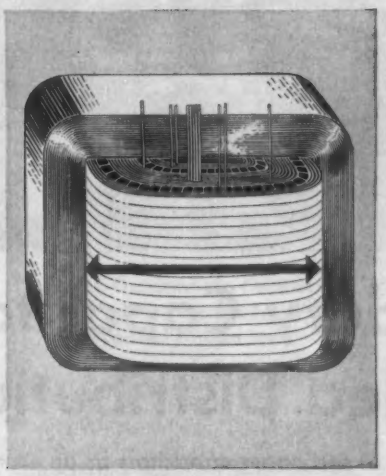


Figure 3. Shell-Type Design

Compare the difference in mean-turn diameter. L-M's Round-Wound design with the long round coils has a lower mean-turn diameter than a shell-type design. This contributes to L-M's low losses, which in turn result in good regulation, greater revenue at all power factors.

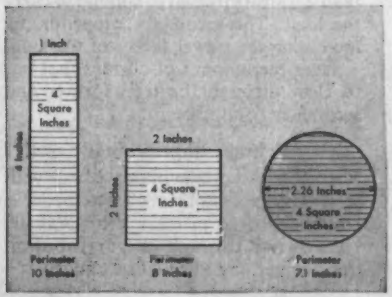


Figure 4. Compare the difference in perimeter. Each of these core cross sections has an area of 4 square inches. It takes only 7.1" of wire to make a turn around the core of round cross section typical of L-M transformers. This results in better utilization of copper, lower copper loss.

Five Reasons Why More Customers Are Selecting L-M Round-Wound Transformers

1. Higher Uniform Impulse Level: Round coils are *wound* into shape. Therefore insulation is not damaged by malleting into rectangular shape. Coils have longer creepage distance between windings and between leads.

2. Higher Short-Circuit Strength: Round coils are not stressed out of shape under high radial short-circuit forces. Strong steel frame, heavy clamping bolts, sturdy maple blocks and varnished coils prevent axial movement.

3. Higher Short-Time Overload Capacity: Round coils and the cruciform cross-section core expose large surfaces to cooling oil. The result is relatively low hot-spot temperatures, which add considerably to high short-time overload capacity.

4. Balanced Performance: The core is a continuous wound strip of oriented steel. Coils are wound directly onto this core. Since the core is not cut, unwound, or disturbed in any way after annealing, there are no air gaps to break up the flux path. This results in low exciting current and core loss.

The wound-core, round-coil design permits fewer winding turns and smaller turn diameter. This results in low impedance, and provides better regulation at all power factors.

5. Additional Capacity on Pole: L-M's new obround tank design makes the unit smaller and lighter, with shorter moment arm from the pole. This combination reduces the bending moment on the pole and crossarms, and thus greatly increases the potential capacity of existing transformer structures.

Transformers

L-M's secondary capacitors are small, light, and very easy to install.

L-M Secondary Capacitors Improve Overloaded Distribution System

L-M offers complete line of secondary capacitors as an economical means to increase load capacity, reduce load losses, and improve voltage level of secondary system.

By **N. K. DELANEY**
Product Manager
Capacitors and Regulators
Line Material Company

The effectiveness and economic worth of secondary capacitors have increased considerably because of the heavy load growth from motored appliances. Many residential secondary systems have been forced to operate with loads having as low as 70-percent power factor.

Advantages of Secondary Capacitors

By improving the power factor in the secondary circuit, secondary capacitors can provide the same benefits as obtained by installing larger distribution transformers, heavier secondary conductors, or voltage regulators, and can do this at appreciably less handling and installation costs. This comparison, of course, must be within the range obtainable by power factor correction.

Transformer Capacity Increased

The maximum benefit from secondary capacitors is obtained at the most advantageous period, which is during peak-load conditions. The chart, Fig. 1, shows the decrease in transformer loading obtained by adding capacitors to the transformer secondary, and Fig. 2 shows the recommended number of capacitor units with various transformer ratings.

Load-Loss Reduction

The combination of transformer and secondary capacitor is more efficient than a transformer large enough to carry the load. The secondary capacitor, by increasing the power factor of the load, reduces the amount of current that has to flow through the transformer and secondary conductors.

Voltage Improvement

The value of voltage improvement with secondary capacitors is equal to the same amount of fixed primary kvar, *plus* the voltage rise through the distribution transformer and affected secondary.

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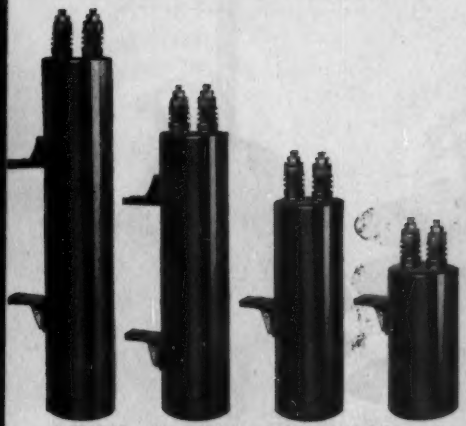


L-M 240-volt secondary pole-mounted capacitors are available in 10, 7½, 5, and 3 kvar ratings. See chart for height and weight.

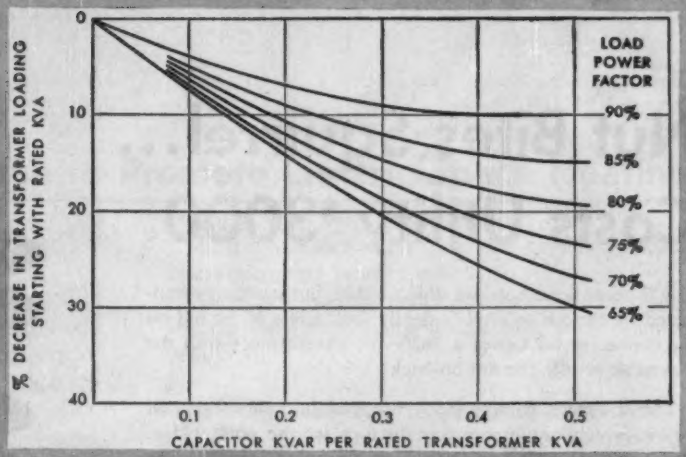
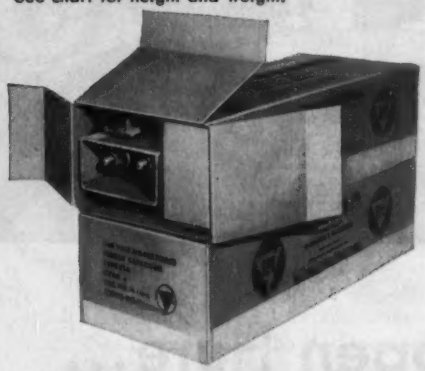


FIG. 1—These curves show how you can decrease transformer loading—at various power factors—by adding secondary capacitors.



L-M's unique carton permits easy testing of capacitors without removing them from the carton.

Distribution Transformer Rating in KVA	Recommended Number of Capacitor Units			
	3 KVAR	5 KVAR	7½ KVAR	10 KVAR
10	1	—	—	—
15	2	1	—	—
25	3	2	1	1
37½	4	3	2	1
50	6	4	2	2
75	9	5	3	3

FIG. 2—The above chart shows the recommended number of secondary capacitor units with various transformer ratings.

Capacitor Location

To obtain the maximum benefit, capacitors should be installed in pairs, located from ⅔ to ¾ the distance to the end of the secondary, in each direction. This recommendation is based on a reasonably uniform load distribution and secondary conductors in two directions from the transformer.

L-M Offers Complete Line Of Capacitor Equipments

L-M's 240-volt secondary pole-mounted capacitors are available in 3, 5, 7½ and 10 kvar.

L-M's 216-volt, 13⅓ kvar submersible capacitors are available in 40, 80, and 120 kvar racks, completely assembled at the factory ready for field installation.

L-M's complete line of primary capacitor equipments includes pole-mounted, single and multi-row racks, factory-assembled blocks and metal-enclosed equipments. Most capacitor equipments are available in 2400- to 13,800-volt, 25 or 50 kvar capacitor units.

Some Outstanding Features Of L-M's Pole-Mounted Secondary Capacitors

Leads of 48-inch, 600-volt wire furnished as standard equipment.

Bushing-Mounted Fuse with 48-inch lead can be supplied.

Solder-Sealed Bushings of strong one-piece wet-process porcelain provide a positive, lasting seal.

Pole-Mounting Bracket has two 9/16" holes for ½" lag screws. Standard EEI-NEMA crossarm-mounting bracket furnished if required. Capacitor can be mounted with bushings up or down.

Aluminum Metallizing process protects steel tank from oxidation; is followed by a chromate primer and a finish coat of alkyd resin paint.

Round-Pack, Round-Tank Design makes these capacitors small, light, easy to install. Unit has a one-minute discharge resistor; is completely impregnated under vacuum with low temperature Elemex liquid dielectric.

Weight and height of L-M's 240-volt, pole-mounted secondary capacitors.		
Size Kvar	Height Inches	Net Weight* Pounds
3	13⅛	17
5	17⅞	23
7½	23⅞	31
10	29⅞	39

Weights include the pole-mounted brackets.

Get The Whole Story On L-M's Capacitor Equipments

Ask the L-M Field Engineer for complete information and bulletins on the construction and application of L-M's full line of primary and secondary capacitor equipments. Or write Line Material Company, Milwaukee 1, Wisconsin.

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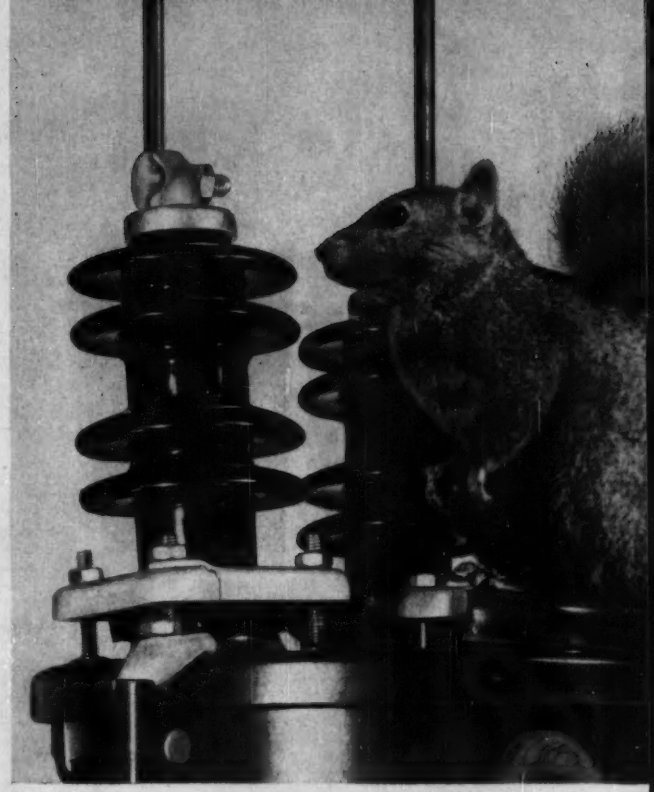
Elemex® Capacitors

Nut Bites Squirrel... Costs Utility $3000



You'll never believe it—we didn't either, but it actually happened! A curious squirrel evidently took a bite of the nut on the connector on top of a 7620-volt transformer—with the inevitable result. The nut bit back!

The squirrel's flaming body dropped into the dry grass below, which caught fire and in turn set the pole ablaze. Eventually the pole burned through, dropping primary wires onto the secondaries below.

Result: the pole had to be replaced—and so did some 30 television picture tubes in customers' homes. The whole deal was embarrassing and costly to the utility company—and to the squirrel's family also, which probably still has never satisfactorily explained to the neighbors what happened to Pappy.

It Can't Happen Here... on L-M's New Bite-Proof Transformer Bushing

This new bushing is designed to take the tap vertically, conforming to EEI-NEMA standards. Not only does it have a hand-tightening knob (which can't be spun off—but can be intentionally removed) but also it has a phenolic cap which covers the terminals completely. No hot nuts or other live parts are accessible.

If you use bare wire jumpers, we suggest a neoprene sleeve, as shown. The phenolic cap is constructed so as to provide adequate drainage.

On protected transformers a 3/16-inch slot is provided for the lightning arrester terminal. Nothing except the most persistent hummingbird sitting on the arrester could reach the hot terminal—and that's pretty unlikely.

This new bushing is representative of the many plus features found only in L-M Round-Wound Transformers®—and another reason why you should order more L-M Round-Wounds. Ask the L-M Field Engineer to tell you other reasons for buying these outstanding and highly efficient transformers. Or write Line Material Co., Transformer Div., Zanesville, Ohio.

284

LINE MATERIAL Transformers

A McGRAW ELECTRIC COMPANY DIVISION

Time to Promote Electric Space Heating

When is the time for a utility to promote electric space heating?

Of course, there is no pat answer to this question. Each utility must decide for itself on the basis of the problems it faces now and those that could germinate in the future. It must examine its load factor, evaluate its rate structure, analyze space heating's load characteristics, and determine how this load will fit in with present loads. Finally, it must take a closer look at its present position and decide how much or how little of the heating market it wants one, five, ten years from now.

But too many utilities aren't investigating the opportunities. This fact shows up strongly in the industry survey which begins a special report on EW's recent heating conference (page 71). After reading it, utilities not promoting resistance heating or the heat pump could well afford to ask themselves these questions:

1. Have we really made sufficient studies of our load characteristics?

Not even 40% of the non-promoting straight electric utilities surveyed had ever run such studies.

2. Are we sure we can't compete successfully with the combustible fuels?

According to the survey, if gas rates in your area are in the range of 50 to 60¢ per mcf and fuel oil is 14 to 16¢ per gal, you're not having it any tougher than many of those which do promote.

3. Is it wise to wait for a summer peak before considering heating promotion?

There are more promoting companies in the survey that still have winter peaks than have summer peaks.

4. Do we really want to sell the all-electric home?

As American Gas & Electric Service Corp's Paul D. Brooks points out (p 77), "Only through the sale of heat pumps and electric house heating will our industry ever realize its much publicized goal of 10,000 kwhr average use per customer."

But what about the cost to serve such volume business? Reports W. T. Richards of Indianapolis Power & Light Co after a study of all-electric homes on his system (p 81): "Compared to the demand contribution from the contemporary gas home, the demand responsibility is not near the ratio of ten to one available in kwhr sales volume."

And apart from its own internal economic considerations, the utility has another factor it cannot ignore—its customers. Gordon Evans (p 76), chief of Kansas Gas & Electric Co, a utility already confronted with a big summer peak, puts it this way: "I feel the public is ready to buy electric heating—year-around electric air conditioning. And they are ahead of the electric utility industry in their thinking. In my opinion the time is ripe for sales of electric heating, and I hope that we as an industry have the vision to at least catch up with our public."

It Will Pay to Support AIEE Meetings

The Winter General Meeting of the American Institute of Electrical Engineers is being held this week. For all utility and industrial engineers this meeting provides an excellent medium for exchanging information on a broad range of important technical problems. Just look at a sample of the meeting subjects of direct interest to utilities: Substations, Insulated Conductors, Relays, Domestic and Commercial Applications, Industrial Power Systems, Transmission and Distribution, Power System Communications, etc.

Preparation and presentation of the papers at these technical sessions involve a tremendous amount of work and effort on the part of the AIEE staff, the AIEE committees, and the speakers themselves. As a result we have a program which merits the respect and the wholehearted cooperation and participation of the beneficiaries.

Support of all the AIEE general meetings by management through participation and the sponsorship of ample representation is highly desirable. It will repay the expense and inconvenience three-fold. And those selected to attend will find that attendance at meetings and participation in paper discussions will provide full compensation for individual efforts and give them additional benefit from membership.

Power Construction Expenditures Proposed by Eisenhower

Agency	Fiscal 1957 (millions of dollars)	Fiscal 1958 (millions of dollars)
Tennessee Valley Authority		
Multipurpose Projects	0.3	0.2
Steam-electric Plants	54.2	77.9
Transmission	26.5	29.8
Army Corps of Engineers		
Multipurpose Projects	139.0	128.6
Partnership Projects	.....	5.0
International Boundary & Water Commission		
Multipurpose Projects	1.5	.....
Department of Interior		
Reclamation Bureau		
Multipurpose Projects	35.1	51.9
Transmission	7.8	8.4
Bonneville Power Administration		
Transmission	24.4	26.5
Southwestern Power Admin.		
Transmission	1.1	1.2
Totals	289.9	329.5

Ike's Budget Still Backs Partnership

- **In State of Union address, he asks for partnership development of Bruces Eddy Reservoir and Oroville Reservoir in Idaho and California, respectively**

- **Seeks legislation on Fryingpan-Arkansas, Niagara development, federal payment of upstream benefits, TVA revenue bonds**

- **Calls for more money for atomic energy development, but none for government-built large-scale reactors**

President Eisenhower in his State of the Union address to Congress and in his 1958 Budget Message reaffirms his "continuing firm support" for partnership.

In terms of money the President asked Congress for $10 million for the Corps of Engineers to undertake on a partnership basis development of Bruces Eddy Reservoir in Idaho, and Oroville Reservoir in California.

He urged that "non-federal" interests should be encouraged to participate with the federal government on previously authorized projects (presumably such as John Day) and stated that similar "partnership arrangements are being considered by the Bureau of Reclamation."

The President urged Congress to take prompt action on legislation for the Fryingpan-Arkansas project and to decide how Niagara should be redeveloped. He asked $1 million to start Fryingpan-Arkansas.

Other legislation for which he asked Congressional approval included a measure for federal payment for benefits received at federal projects from upstream non-federal projects. "In simple equity the government should pay" for such benefits, he said.

The total federal budget for power construction, after three straight years of decline, has begun to rise again. The President this year has asked for a $39.6 million increase in construction funds for fiscal 1958 over 1957. The $329.5 million total in funds for power projects still falls below the $368.4 million spent in fiscal 1956, but is above the 1957 total.

The President also asked increased funds for atomic energy development but again confirmed his belief that construction of large scale commercial power reactors should not be undertaken by the federal government. Therefore, "no funds for construction of new large-scale reactors are proposed in this budget." The President warned, though, that if industry didn't come forward soon with acceptable proposals for reactors, he would seek funds to let the government do the job.

Here are budget highlights:

Water resources: A total of 30 water resources projects are recommended for starting in 1958. Appropriations of $17 million are included for 1958 preliminary investigations of river basin and other construction programs, including continuation of the Passamaquoddy Bay hydroelectric study.

The Corps of Engineers will continue construction of 24 multiple purpose projects, including 2 additional power generating units at Table Rock Reservoir, Mo., and 5 additional units at Oahe Reservoir, S. D.

The Bureau of Reclamation's program calls for continuation of 71 irrigation and power projects, including 21 units in the Missouri River basin project and 3 units of the

Colorado River storage project.

Tennessee Valley Authority: Because of the apparent need for new generating capacity after 1960, the President recommends legislation to authorize TVA to sell revenue bonds, subject to regular budgetary review. After Congress has passed such legislation, he says, TVA power requirements will be reexamined. In the meantime, he requests $30 million for a 180,000-kw addition to an existing steam plant of which $3 million would be spent in 1958. Other expenditures for the next fiscal year will include completion of 7 generating units started previously, and cleanup work on 5 steam plants.

Power facilities: At end of 1956, federal generating capacity totaled 18.7 million kw, or about 16% of total capacity of Class I electric utility systems in the U. S. Additional capacity of 2.5 million kw is scheduled for completion in 1957 and 1958 with substantial amounts scheduled for later years. Capacity now programmed, when completed, will total 25.9 million kw.

Expenditures for transmission facilities and substations by TVA, Reclamation, Southwestern, and Bonneville Power Administrations in 1958 will total $66 million. This will add 759 miles of lines to the federal total of 28,300 miles.

Atomic energy: The budget calls for $2.5 billion for AEC in 1958 compared with slightly less than $2 billion in 1957.

The civilian power reactor program gets a big boost in funds: $95.0 million compared with $59.6 million in 1957.

The budget message notes that increasing effort is being devoted to developing competitive electric power from atomic reactors. The increased funds are to permit AEC to explore new power reactor concepts, operate reactor experiments and develop basic reactor technology. "Increased support will be given," states the message, "to the growing activities by private industry and public power bodies in power reactor development."

More money and men, the message adds, are to be devoted to developing thermonuclear (hydrogen) power reactors.

The President also says that legislation will be proposed to authorize federal liability insurance against nuclear accidents. Sen Clinton Anderson and Rep Melvin Price have jointly introduced legislation along the lines the Administration supported last year.

Finally, the budget provides for aid of various kinds designed to help alleviate the shortage of nuclear scientists and engineers.

Rural electrification: The budget message calls for $185 million for new electrification loans compared with $170 million last year.

WASHINGTON COMMENT

AEC Lifts Some Secrecy from License-Granting Routine

The Atomic Energy Commission—long under attack for its secrecy practices—on its own initiative has adopted a procedure indicating new sensitivity to public reaction to civilian atomic activities.

The commission has introduced quietly a change of procedure on licensing atomic construction projects. It is designed to:

- Pacify AEC's critics in Congress.
- Circumvent embarrassing situations for AEC.

The first evidence of this new procedure came Dec. 28 when AEC gave notice of a proposed issuance of a construction permit for an industrial research reactor to be built by AMF Atomics, Inc, near Princeton, N. J.

This statement announced AEC's intention in advance. It drew attention to publication in the federal register of such a notice of issuance of a construction permit. And it gave interveners 15 days in which to request a formal hearing.

More significant, though, was publication at the same time of a complete description of the proposed reactor, and a detailed "hazard analysis."

On Jan. 2, AEC again displayed its new policy by extending this procedure to a reactor for export to Brazil, although in this case the detailed description and hazard analysis were omitted. But on Jan. 4, in the case of a testing reactor to be built by Westinghouse Electric Corp in Westmoreland County, Pa., AEC again gave all the facts, including a detailed "hazard evaluation."

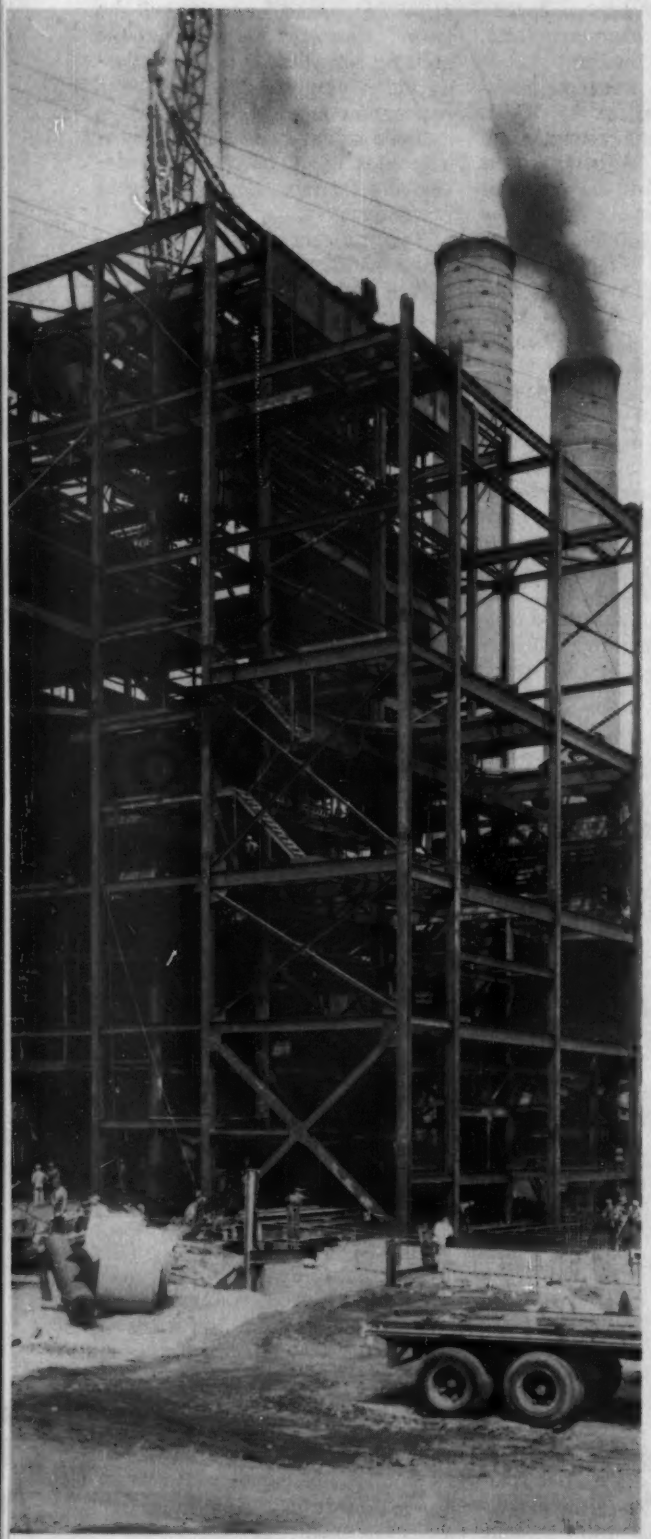
When, last summer, criticism of AEC began building up for its overall handling of the PRDC construction permit, one of the big complaints made was against AEC's withholding vital information from the public. Sen Clinton P. Anderson (D-N. M.), then chairman but now vice chairman of the Joint Committee on Atomic Energy, promised that this year he would seek an amendment to the Atomic Energy Act to make it mandatory for AEC to give "full disclosure of safety hazards" to the public, and to state and local governmental bodies "before a construction permit is issued."

This is precisely what AEC is now doing.

By itself, the new AEC procedure may not be enough to stop the promised drive by Anderson and other Democrats to reorganize the commission. But it goes a long way toward meeting the kind of criticism from which the reorganization drive sprang.

Should the present procedure not satisfy the AEC or the Joint Committee, there is yet another procedure set out under the regulations. This would be to call for formal hearings automatically on all construction permit applications. As of now, there is no indication that this procedure will be adopted.

Utilities Hustle Plant Expansion;



EARLY STARTER: A 225-Mw addition at Appalachian Electric Power's Glen Lynn plant is slated to begin operation soon

• Transmission, distribution building apparently will gain on outlays for generating plant during the current year

• Office, service buildings vie with substations in utilities' budgets

The nation's electric utilities have budgeted a $4.8 billion expansion program for the current year—an average outlay of $19 million for every working day. Full and complete rundown of these budgets will appear in Electrical World's Statistical Issue next week. Meanwhile, here is a compilation of recent budget and construction announcements:

EAST: Utility Budgets $1¾-Million a Week

Philadelphia Electric Co plans to spend around $1¾ million a week for a five-year total of $460 million. Major current project is the new Eddystone station with first 325-Mw turbine-generator planned for operation in 1959 and second in 1960. Extensive transmission additions will tie Eddystone into system.

Pennsylvania Electric Co anticipates a 10% gain in sales during the year and will spend $23 million for system expansion. Ground will be broken for a 180-Mw addition for the Shawville station. Other earmarked expenditures will include $3 million for high-voltage transmission, $2.2 million for substations, and $8.6 million for distribution facilities.

Delaware Power & Light Co has budgeted $28 million for this year. Major projects include two 80,000-kw units at the Indian River plant and a new service building near Salisbury, Md.

Atlantic City Electric Co will spend nearly $19 million during the year, about half of which is allocated for additions at Deepwater station.

West Penn Power Co has announced plans for a 156,250-kw unit at its Armstrong Station in addition to the 165-Mw unit already under construction.

NEW ENGLAND: Yarmouth Plant Takes Shape

Central Maine Power Co's new Yarmouth generating plant is taking shape rapidly with the first of two 44-Mw steam units to begin operation in December.

Citizens Utilities Co has declared its intention to build a 3.6-Mw hydro plant on the Clyde River near Newport, Vt.

SOUTH: Florida P&L, $50 Million a Year

Florida Power & Light Co has laid out a 10-year, $496 million expansion program to double present generation capacity of one million kw. That will mean an average yearly outlay of nearly $50 million. Cur-

Will Spend $19 Million a Day

rent major project is a 180-Mw addition to the Ft. Lauderdale station.

Louisiana Power & Light Co has a $28-million construction program scheduled for the year with a 210-Mw addition to its Sterlington station, additions to its new 230-kv transmission system, and distribution improvements.

Monongahela Power Co has budgeted $8.3 million for construction during the year. Bulk of spending will go for new transmission lines and distribution facilities. Only $1.3 million is allocated for repair and maintenance of generating facilities.

MIDWEST: Consumers to Spend $77 Million

Consumers Power Co has allocated $64 million for electric projects during the year and another $13 million for office and service buildings. It expects to complete generating units totalling 312 Mw and continue construction on the Dan E. Karn plant. It will double the capacity of its interconnection with Detroit Edison Co to a total of 200 Mw.

Bulk of Union Electric Co's budgeted capital expenditures this year will go for transmission and distribution facilities. Of the $63-million expansion, $41 million will be spent on transmission and distribution.

Wisconsin Public Service Co has allocated $13.5 million for a 75-Mw addition at its Pulliam station.

Minnesota Power & Light Co has charted a $30-million expansion program over a four-year period. This will include doubling the present 65-Mw capacity of the Clay Boswell steam station, new transmission, distribution, and substation facilities.

Northern Indiana Public Service will add two additional 138-Mw generating units at its Dean H. Mitchell station where one unit is being built.

ROCKY MOUNTAIN: $33.5 Million Scheduled

Public Service Co of Colorado will spend $33.5 million on construction this year—an increase of $5.5 million over 1956. Of this, $11.2 million will go for continued construction of two new power plants.

SOUTHWEST: Plants A-Plenty

As part of Houston Lighting and Power Co's five-year, $250-million expansion program, it has underway a new plant to serve the northwest section of metropolitan Houston.

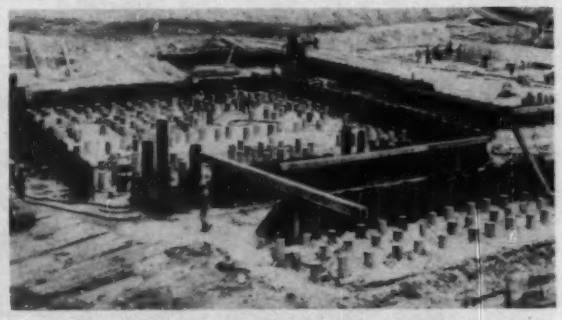
Central Power & Light Co has let a $1.5-million contract for the building and structural work on its planned $7-million J. L. Bates station.

Public Service Co of Oklahoma recently announced plans for a 500-Mw plant to be built in the vicinity of Ologah dam on the Verdigris River. Construction will start next year.

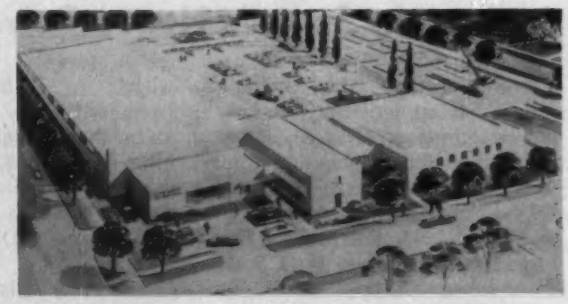
Arizona Public Service, California Electric Power, and the Imperial Irrigation District have teamed up to build a 160 Mw steam station near Yuma, Ariz. Estimated cost is $20 million.

Salt River Power District, Phoenix, Ariz., has set

THIS 400-MW HYDRO PROJECT at Noxon Rapids in Montana will cost Washington Water Power Co about $85 million



SHEET PILING separates one construction area from another at Mississippi Power's Gulfport plant; speeds up building



SERVICE CENTER to be built by Seattle City Light Dept is $1.2 million structure. Contract award set for this month

"NPPA recommended a $2.5-billion hydro program . . ."

a construction budget of $16.4 million for 1957. Of this amount, $6.5 million will go for transmission and distribution facilities; the remainder toward construction on the 200-Mw Agua Fria steam plant.

Brazos Electric Power Cooperative has broken ground for a $6-million plant near Weatherford, Texas.

PACIFIC NORTHWEST: Millions for Hydro

Four of the five members of the Puget Sound Utilities Council will spend $100 million a year for the next eight years in developing hydro resources. Projects include Seattle City Light Dept's Gorge and Boundry Dams, Tacoma Public Utility Dept's proposed Mayfield and Mossyrock Dams, Puget Sound Power & Light Co's Upper Baker, Lower Baker and Snoqualmie plants; and Chelan County Public Utility District's Rocky Reach Dam.

Electric companies headquartering in Portland, Ore., have slated approximately $79 million in construction for the year. Of this, Pacific Power & Light Co intends to spend $50 million and Portland General Electric Co, $29 million.

Idaho Power Co has scheduled $47 million for construction, the bulk of which will be applied to its Hells Canyon power projects.

The Northwest Public Power Association has recommended to President Eisenhower a 10-dam, $2.5-billion, hydro-development program to create an estimated 21.5 million kw of power.

WEST COAST: PG&E Slates $190 Million

Pacific Gas & Electric Co has budgeted $190 million for expansion during the current year, a share of which will go toward doubling the capacity of the company's 660-Mw Pittsburgh plant. Two 325-Mw units will be added—one scheduled for service in 1960 and the other in 1961.

Sacramento Municipal Utility District has budgeted $9 million for construction and additions to plant this year. All of this will go for transmission, distribution, and office facilities. The District recently received approval for a $8.8 million loan from Rural Electrification Administration for extension and heavying-up of its rural system.

LINE STRINGER gets its superstructure loaded aboard a DC6A for fast flight from San Francisco to Newark, N. J. Time savings justified higher freight rate

TRANSFORMER COIL, for 50,000-kva unit, is crated and flown East to West

Air Freight Speeds Heavy Power Equipment Delivery

In two instances recently, air freight has sped delivery of heavy power equipment. Day & Zimmerman Co of Philadelphia had a line-stringing machine flown to Newark, N. J., from San Francisco for use on a transmission link between Dunwoodie and Millwood for Consolidated Edison Co of New York Inc.

The 8,700-pound device was shipped in a DC6A in three parts: wheels, its 24-ft-long frame, and its superstructure. It was assembled at the Newark airport. This shipment cost only $200 to $300 more than it would have by rail, and arrived in three days instead of three to four weeks, Day & Zimmerman reported.

Air freight also helped General Electric Co get a repaired transformer back on the job in seven weeks. A 50,000-kva unit arrived at GE's Portland, Ore., shop needing a high-voltage coil which had to be made at Pittsfield, Mass. Working on an emergency basis, the Pittsfield shop made the coil in four weeks, instead of the normal 12. The 8,600-pound part then was flown to San Francisco. Repaired transformer arrived "home" in time to help meet the winter peak.

New Utility Groups Plan Nuclear Power Plants

Electrical World survey reveals that industry is eager to forge ahead in co-operative private development of reactors

Electric utilities in many sections of the country are actively making plans for cooperative construction of nuclear power plants in the near future. Furthermore, about three or four new groups, varying in size from four to 20 members, have been formed specifically for this purpose.

This trend was revealed in a recent survey made by Electrical World, in which 39 selected utilities were queried to discover if the industry individually or in groups plans to forge ahead in building additional plants or whether the utilities would rather wait until projects previously announced have gone into operation.

The survey clearly indicated that the industry is not going to wait. These new groups have formed for the sole purpose of evaluating and in all probability, building additional nuclear power plants.

Most of the utilities participating in these new groups are not already members of existing groups, such as Power Reactor Development Co and Nuclear Power Group.

The new groups are giving most serious consideration to small size reactors of from 30 to 60 Mw. (In addition to these projected reactors, plans for a 20 Mw prototype reactor were announced recently by Middle South Utilities. MSU is expected to receive proposals from four firms sometime in February.) The heavy water type reactor is also being considered.

Present Plans Made On Group Basis

The survey also revealed that all of the utilities interested in building additional reactors are making plans on a group basis. No one company has made a commitment or is seriously considering building a reactor plant as an individual.

These new groups are being formed principally on an area basis. Along with those groups previously announced, they represent almost all sections of the United States.

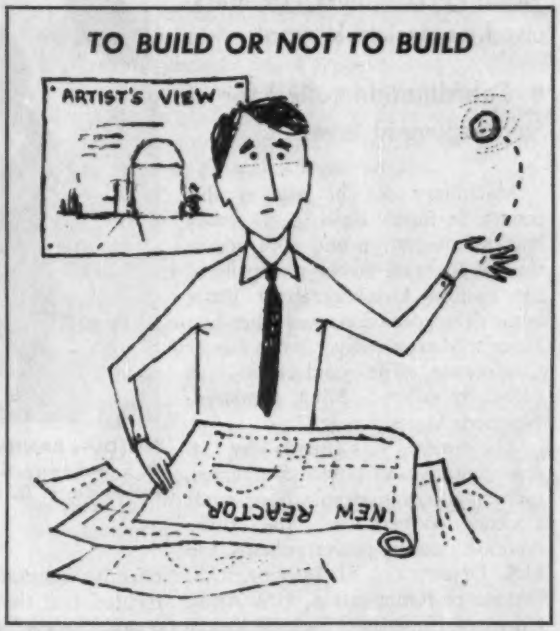
Largest of the new groups would have approximately 20 participants and is considering a 30-60 Mw boiling water reactor. The smallest organization, which would be composed of between four and six participants, is considering a plant costing between $20 and $60-million, depending on the size and type of the reactor.

The remaining groups, in which 10 to 15 companies would participate, have not yet revealed their definite plans for size and type of reactor.

About 20% of all the companies queried (most of which are members of existing groups) replied that they are not considering any additional effort until results of existing projects are more definite.

While those already engaged in existing efforts are not considering further participation in additional nuclear power projects at present, they are taking an active part in the development of this relatively new field. According to a top industry spokesman, every effort is being made to anticipate and overcome a shortage of technically trained manpower through a program of on-the-job training for employees and comprehensive study assignments for executives.

There are also indications that when group projects now underway are completed, participating utilities may engage in individual construction of nuclear plants.



NUCLEAR NOTES

The second reactor at Calder Hall Atomic Power Station has gone into operation. Loading will still be continued to reach the quantity necessary for maximum power production. When both reactors at the station are operating on full power, they will have an installed capacity of 92 Mw, of which approximately 70 Mw will be produced for the national grid.

Newly elected chairman of the Joint Atomic Energy Committee is Rep Carl Durham (D-N. C.). Sen Clinton P. Anderson (D-N. M.) was elected vice chairman of the 10-year-old Congressional committee.

A new booklet entitled "Electric Power from the Atom" has recently been prepared by the Edison Electric Institute, 420 Lexington Ave., New York, N. Y. It describes in layman's terms, how atomic energy is used to produce electricity, why it will be an important source of energy, and what the electric utility industry is doing to develop this new source of energy.

Missouri Basin Power Pool Studied

- **Better overall economy, yielding consumer benefits, cited as desirable goal**
- **Coordination called for at "management level"**

Machinery set in motion this month in Sioux Falls, S. D., may lead to integration and pool operation of the vast power resources of the eastern Missouri River Basin area. The occasion was the first Eastern Missouri River Basin Power Conference. The conference was called by Allen S. King, president, Northern States Power Co.

The meeting was attended by 178 representatives of power companies, municipal power organizations, rural electric cooperatives, the three Nebraska public power systems, the U.S. Department of Interior, U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, Federal Power Commission, and Rural Electrification Administration.

MISSOURI BASIN transmission lines are studied by K. G. Tower, FPC; Maj Gen G. E. Galloway, Corps of Engineers; D. A. Hamil, REA; A. S. King, Northern States Power Co; F. G. Aandahl, Dept. of Interior. A new power pool may be result

Studies Point Up Need

In keynoting the meeting, King said the idea for the meeting was prompted by studies made over the past two years by engineers of 12 power companies. One conclusion was that a unified approach was needed for the whole area.

Speaking for the Department of Interior, Fred G. Aandahl, Assistant Secretary of the Interior, called attention to the gains that had been made in other sections of the country through integration of various power facilities.

Interior Is "Sympathetic"

Aandahl said that there was enough water in the Missouri River for 55% load factor of the 1¼ million kw of generation installed or authorized. Integration of power facilities in the Missouri Basin would add to capabilities of plants and transmission facilities of all in the area without additional investment. This, he said, would mean lower cost power to the ultimate consumers. For this reason, said Aandahl, it is the duty and responsibility of all to accomplish the most effective integration possible. He indicated that the Department of Interior was sympathetic with the objectives of the conference and was interested in exploring the possibilities of integration.

REA Administrator David A. Hamil said that pooled power facilities benefits the ultimate consumer. He said that it is the policy of REA to let local people decide how they want to operate, but he invited all cooperatives to participate in a coordinated effort. He offered the facilities of REA to bring about the most efficient way of providing electric service in the area.

Engineers Corps Backs Idea

Maj Gen G. E. Galloway, division engineer, Corps of Engineers, said that the Sioux Falls meeting was most timely, that four dams on the Missouri already have a generating capacity of 712,000 kw and that these facilities are integrated by Bureau of Reclamation transmission lines. But, he said, integration with other systems is important, and that the Corps of Engineers was in sympathy with purposes for which the Sioux Falls meeting was called. He said the Corps would be glad to cooperate.

Kenneth G. Tower of the FPC said that the commission has available data on power requirements and capability of both federal and non federal power facilities in the area. He said that it would be the task of the conference's engineering committee to use this data profitably.

"Policy Interconnections" Needed

D. J. DeBoer, executive director, Nebraska Public Power System, told the conference that the pooling of reserves in the area would probably be the most important benefit of integrated operation. DeBoer thought that area groups need coordination at the management and policy-making level, that there was a need for policy "interconnections" of the agencies.

Hibbert Hill, chief engineer, Northern States Power Co—in reporting on the study made over the past two years by 12 of the investor-owned utilities in the area—said: Hydro capabilities in the area will be exhausted by 1965; 100,000 kw of additional steam generation will be required annually beginning in 1965, to meet growing load; and integrated operation is "inevitable."

Hill later was elected chairman of the engineering committee; George A. Lewis, Bureau of Reclamation, was named vice-chairman; and E. R. Mackie, Central Power Co-op, was made secretary. The committee is to meet March 28.

To Shed Light . . .

Middle West Service Co of Chicago has worked out a plan which may yield long-sought data on the elusive residential lighting curve. In collobaration with the load research committee of the Association of Edison Illuminating Companies, Middle West has prepared a brochure to guide utilities who will participate in a nation-wide experiment aimed at measuring residential lighting loads directly.

Each participant will be asked to meter the lighting circuits of two or more residential customers in each of three groups, based on total yearly consumption. They are:

Group 1: Customers using 1,000-1,500 kwhr.
Group 2: Customers using 2,200-3,400 kwhr.
Group 3: Customers using 5,000-8,000 kwhr.

Middle West hopes that at least 50 AEIC member companies will participate.

Atomic Battery Coming?

The Russian newspaper "Moskovski Komsomcets" has reported that Soviet scientists are working on an "atomic" battery to power automobiles and motorcycles. The paper said such a battery, filled with strontium, had been created, but that it was too weak to move a bicycle. However Russian scientists are working on a "more powerful" battery, the paper said. It will be filled with lead or graphite, and should be on the market "within the next few years."

A Little Homework . . .

Clemson College has dished out a little homework for the Corps of Engineers, now engaged in building Hartwell Dam on the Savannah River between Georgia and South Carolina. Clemson officials say that the proposed dam will inundate valuable agricultural property on the campus and create "unsightly marshes" during low water periods. They have asked the Corps to lower the height of the dam 50 feet from its proposed 660-ft-above-sea-level elevation.

Some construction already is progressing. But the Corps agreed to let no more contracts until it could study possibilities of altering the design plans—which now provide for an ultimate 66-Mw capacity. A Corps spokesman estimated it will take three to six months to make the study.

Terrible Terry Strikes

"Terrible Terry" Carpenter, Nebraska state Senator who nominated "Joe Smith" for vice-president at last fall's Republican National Convention, has introduced five bills into the state legislature aimed specifically at Consumers Public Power District. Main intent of the bills appeared to be to make it easier for towns to take over Consumers' distribution systems. Sen Carpenter said he favors Consumers' remaining in the generating and transmission business, but wants it to offer its distribution facilities to municipalities before 1972, and without cost, as present statutes require.

Legalizing Three Lines

Mississippi Public Service Commission has granted Mississippi Power Co permission to build three lines into territory served by Singing River Electric Power Assoc. Mississippi Power sought to serve the new mult-million-dollar Costal Chemical Co, and a dredging company now deepening Bayou Casotte channel in Jackson County. The Commission's order enables MPCo to build the lines, but specifies that the company could serve only those two customers.

Carolina P&L Acts Fast

Carolina Power & Light Co, Raleigh, N. C., filed a protest fast after Southern railroads asked Interstate Commerce Commission for an emergency increase in freight rates—including 10¢ a ton on coal.

CP&L told the ICC that last March's boost already has cost the company nearly $200,000, and the proposed 10¢ hike would cost another $144,000 next year. Duke Power Co, South Carolina E&G Co, Georgia Power Co, and Alabama Power Co also are filing protests.

Raymond S. Talton, CP&L superintendent of power, estimated that the company spent $6.5 million in freight on coal last year. If freight rates continue to rise, he said, it might become feasible for CP&L to build steam plants outside its territory near coal mines rather than build plants within its own territory.

Fish Foiler

Pennsylvania Electric Co has installed a $50,000 screen over its Front Street Station cooling water intake tunnel to keep schools of gizzard shad from clogging the condensing system. Built of rust-resistant galvanized steel, the screen consists of twelve 5x10-ft panels of ¾-in. mesh framed in H-columns. Framework is 50 ft long, 20 ft high, and 6 ft wide. The screen will be used November through April, attended 24-hr-a-day by two-man teams. Behind this screen is the station's four traveling screens—the speeds of which are being tripled to 30 ft a min.

MASTER CONTROLS are on the center of the turbine board (at left), and boiler control, recorders, and television receivers are in the background. During the station's conversion, the electrical control board (right) was not changed

Redondo Control Is Centralized

GENERATION
Design

$1,015,000 conversion permits 6 men to operate 4 72-Mw units, 7 boilers, and will save its cost within about 5 years

H. T. JUREWITZ, Design Engineer, Southern California Edison Co, Los Angeles, Calif.

Centralized control at Redondo Steam Station, Plant 1, will reduce the cost per kwhr significantly and release trained operating personnel to other plants on Southern California Edison Co's expanding system.

More efficient operation under centralized control, plus the savings in operators' salaries, determined the economic advisability of going ahead with the estimated $1,015,000 conversion job. It is expected that lower operating costs will return this expense wthin 5 years.

Reassignment of operating personnel to other plants is of equal importance. Redondo Plant 1 was completed in 1949. By early 1957, Edison will have added eight turbogenerators at four plants. Effective capacity increase will be 1,314 Mw, or 180% in 8 years. These units, together with contemplated new construction in 1958 and 1959, have made urgent the need for trained operating personnel.

Operates Over 20:1 Range

Centralized control at Redondo will allow 28 operators to be reassigned to other plants.

Redondo Steam Station, Plant 1 has four 72,000-kw turbine-generators and seven 400,000-lb per hr boilers which produce steam at 900 psig and 850F. The plant, considered the company's most modern design in 1949, features automatic operation throughout a 20:1 load range, controls operating automatically to accommodate changes in main generator electrical load.

As shown in Fig 1, automatic controls were located throughout the station on boards as close as practicable to the controlling equipment. Such "local" control minimizes the length of control tubing and wiring. This arrangement required 13 operators per shift to supervise operation at and from the local control boards. With centralized control,

six men can supervise the same operation from the central control room.

The existing electrical control room was utilized to house the centralized control equipment. Existing control boards were retained as relay boards to be used as in plants designed for centralized control. Essential instrument measurements at local boards are transmitted to corresponding panels in the control room. Control system additions have been placed so that the control room operator can transfer from automatic to remote-manual, as was done previously by the boiler and turbine operators.

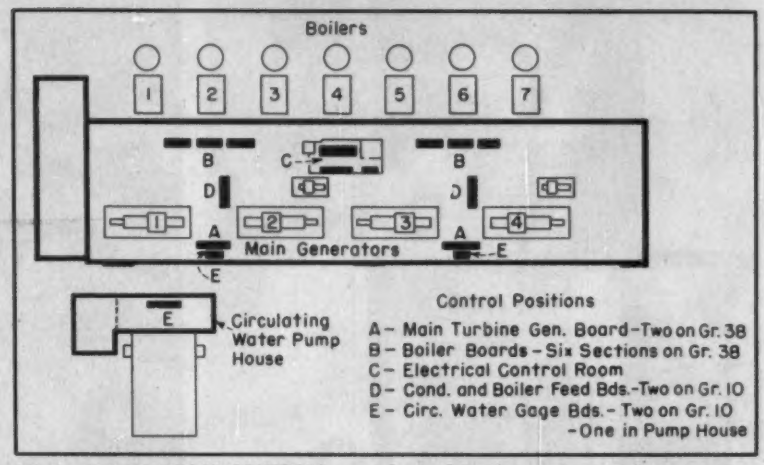


FIG 1—INITIAL LOCAL CONTROLS were located in the station as close as practicable to controlled equipment. This scheme required 13 operators per shift

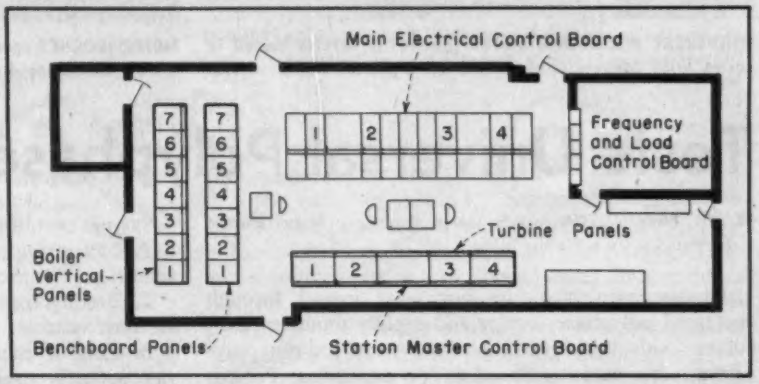


FIG 2—CENTRALIZED CONTROL brings essential measurements from local boards to panels in central control room. Six operators now supervise the operation

Data Are Transmitted

Facilities added for centralized control are in two main groups. First, supervisory instruments and recorders of temperature, pressure, and flow measurements at critical points throughout each operating system are provided. All mechanical measurements, such as temperatures and pressures, are transmitted to the control room pneumatically or electrically. Except for control service air pressure, no primary fluid lines are extended to the control room for measurement. The second group includes facilities for starting and stopping motor-driven equipment and assuming manual control of important regulating devices.

Control systems remain unchanged as far as automatic operation is concerned. No pneumatic control lines were looped in and out of the control room. Instead, a manually-controlled air pressure from the central control room is substituted for the corresponding control air pressure from the normal measuring system. Hence, each control device can be controlled remotely from and returned to local automatic control by facilities in the control room.

These controls and instruments are grouped on panels arranged in the control room to facilitate the central control operation. Overall arrangement of these panels is shown in Fig. 2. Systems common to the overall station and serving all turbine-generators, boilers, and station services have their instruments and controls mounted in general on a station master control board. These comprise main steam, primary fuel oil, fuel-gas supply, and service and instrument air. General station water service, mechanical services, and supervisory annunciators for the general station electrical systems are included.

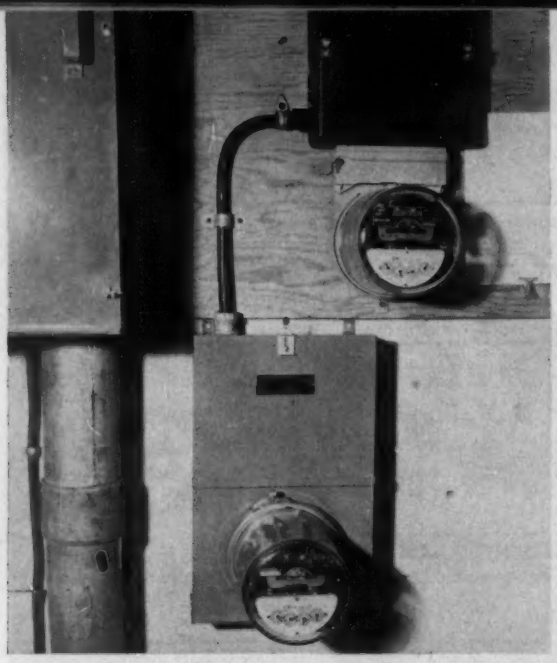
Opposite Electrical Board

Similarly, controls for the turbine, circulating water, condensate and feed water systems for each turbine-generator are combined on turbine boards 1, 2, 3, and 4. These are approximately opposite their corresponding generators on the main electrical control board. Panels for each boiler consist of a benchboard for the controls and instruments, backed by a vertical panel for recorders and furnace and water gauge television receivers. Frequency and load control equipment was relocated on the south wall of the control room and mounted on a new board. The main electrical control board was not changed.

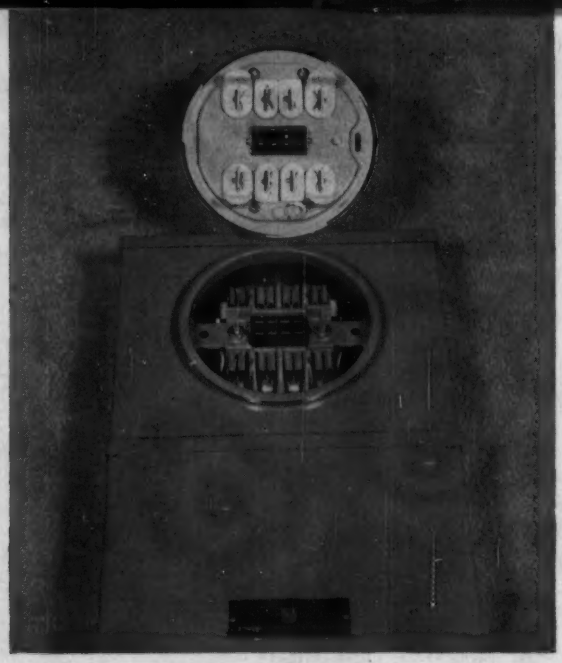
Controls and instruments not considered essential were omitted from centralized control panels. Annunciator drops indicate any abnormal operating condition. Thus equipment is operated by three operators assigned to the general station and directed from the central control room.

To adapt the existing electrical control room for centralized control, a concrete block wall extension was added to the north. Hollow spaces in the blocks were filled with concrete to minimize sound transmission during construction. The old ventilation system was enlarged and redesigned to provide one complete air change every 3 min. New semi-indirect fluorescent lighting fixtures replaced the old lighting system.

(Continued on page 136)



UNIVERSAL POLYPHASE METER (above) is service tested in series with conventional meters on 3-phase 4-wire service



METER SOCKET gets extra terminals by addition of an 8-wire connector on strap between the heavy current jaws

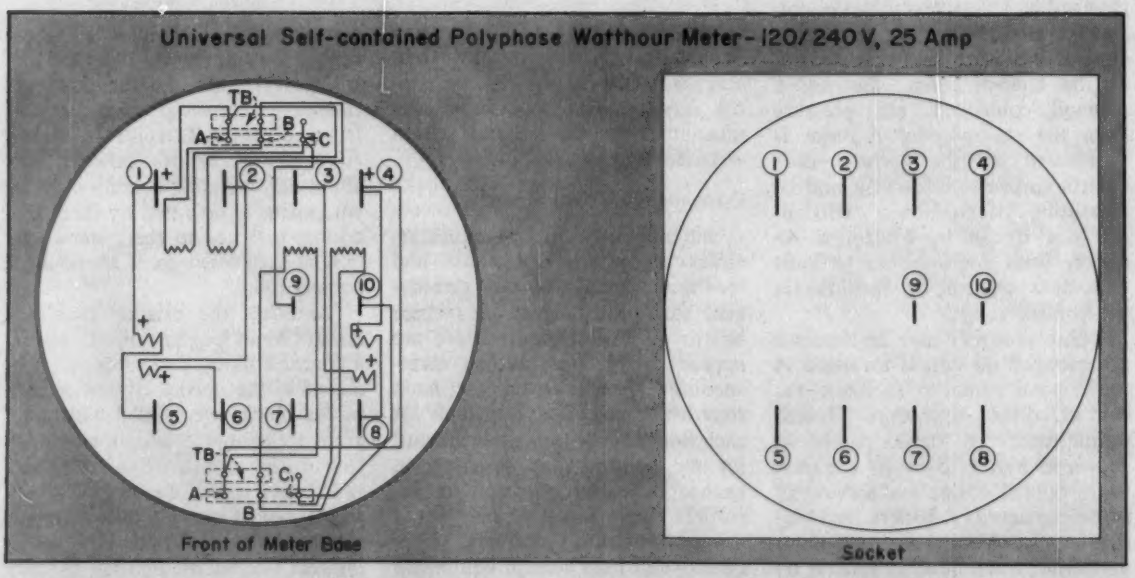
Tests Universal Polyphase Meters

W. H. **FARRINGTON**, Staff Meter Engineer, Texas Electric Service Co, Fort Worth, Texas

Obsolescence of future polyphase meters through increased polyphase service and rapidly mounting customer loads could be minimized were today's polyphase meter output reduced to two capacities. Present production could be limited to those for use on the most predominant polyphase circuits.

Savings would ensue from reducing the following:

1. Meter shop, service center, and service truck inventories.
2. Testing cost, as only two meters would be used on most systems.
3. Cost of changeout for tests. Any mounting device properly connected for a particular circuit would fit when the proper one of two proposed meters is used. A first-class meterman would not be needed.



SELF-CONTAINED UNIVERSAL WATTHOUR METER has two stators with two current windings on each. Mounted on the socket shown above, this meter would have a nominal rating of 15 or 25 amp but could be used up to 100 amp

4. Stock cost by using the same type of 120-v demand motor coil for any connection of the meter.

Texas Electric Service Co has designed a self-contained polyphase meter and another for use with instrument transformers. Basic designs of each include two stators, each having two current elements and one potential coil.

The potential coil is double-voltage rated and can be connected for either 120 or 240 v.

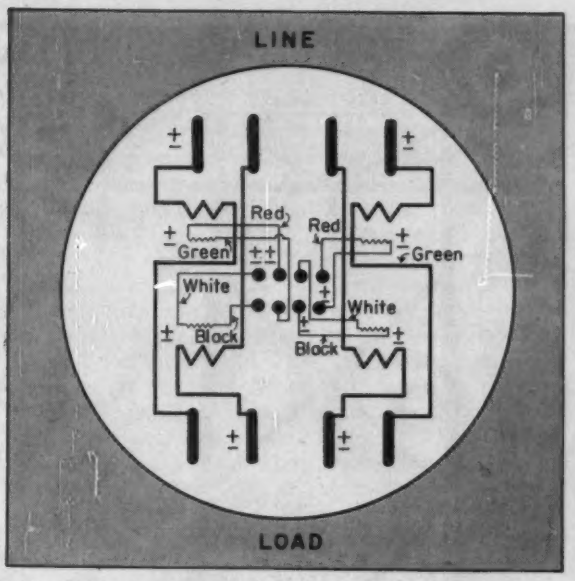
The self-contained meter has a nominal rating of 15 or 25 amp, but can carry 100 amp continuously. The instrument-transformer-type meter, rated 2.5 amp to match instrument transformers, can carry 10 amp continuously.

Either meter measures the load of these circuits:

1. Three-wire network, 120 v.
2. Three-wire 3-phase, 120 v.
3. Three-wire 3-phase, 240 v.
4. Four-wire 3-phase delta, 240 v.
5. Four-wire 3-phase wye, 120/208 v.
6. Four-wire 3-phase wye, 277/480 v.

Although a 240-v potential coil could be used, better overall results are obtained with the double-voltage-rated unit. Such meters have more nearly the desired torque under all circuit conditions. When a 240-v coil is used under all conditions, meter torque at times could depreciate to half of what it would be on another circuit of equal loading. The double-rated coil can be used also as an autotransformer to drive a 120-v demand motor on all applications.

Higher-capacity self-contained meters are not contemplated. It is intended that current above 100 amp be metered with the instrument-transformer type. Loads between 100 and 200 amp would require small CT's for use in a mounting device no larger than present high-capacity meter mountings and at a price that would be competitive. Such transformers would enable 200-amp loads to be measured in 200-amp meter mounting devices, avoiding the difficulties of getting the 200 amp in and out of self-contained meters and eliminating bypass arrangements.

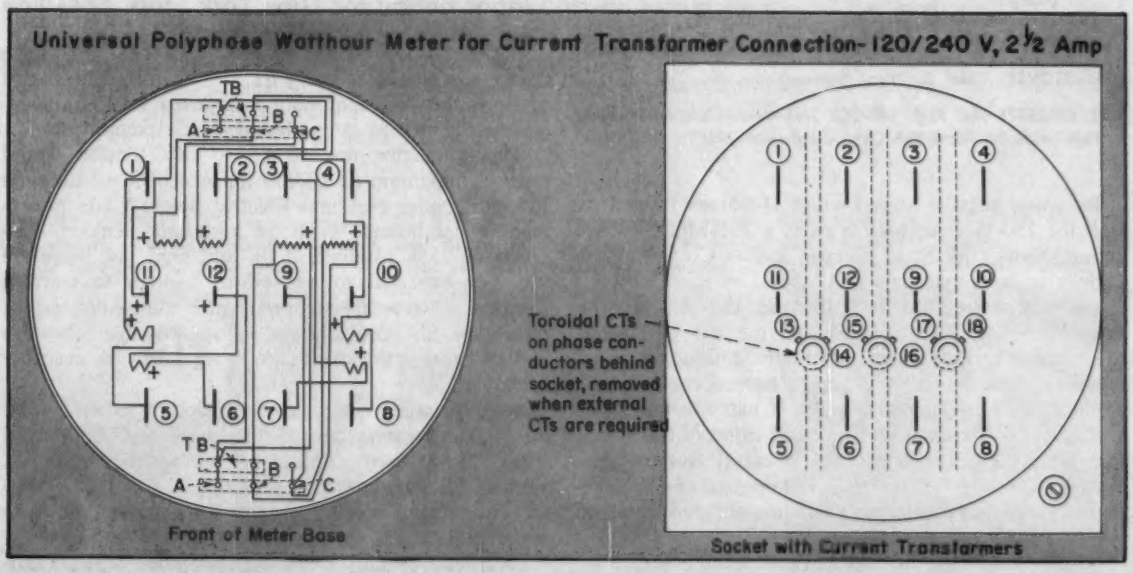


UNIVERSAL POLYPHASE METER on test has terminals for socket connection in six different service applications

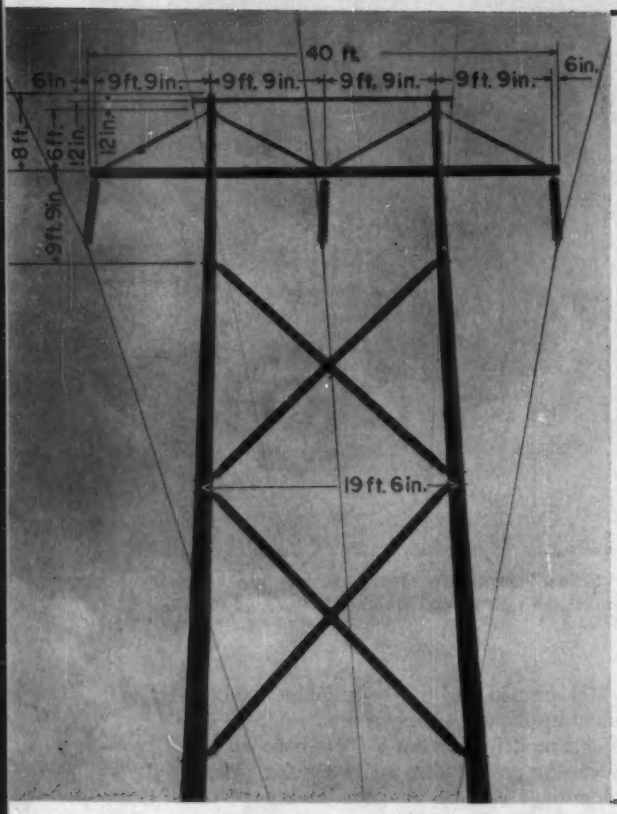
A test model of such a CT has been made. It probably can be produced at an acceptable price.

Mountings can be designed in many ways. Users and manufacturers would have to agree on a standard. But all current and potential terminals should be brought to the outside of the meter for connection to any circuit without removal of the meter cover.

Six preliminary models of the instrument-transformer-rated meter, installed in series with standard types, are performing as well as the conventional meters.


Universal Polyphase Watthour Meter for Current Transformer Connection-120/240 V, 2½ Amp
TB
A
B
C
Front of Meter Base
Toroidal CTs on phase conductors behind socket, removed when external CTs are required
Socket with Current Transformers

INSTRUMENT-TRANSFORMER TYPE UNIVERSAL METER would also have two stators with two current coils on each. But the socket would have provision for small current transformers to match the 2½-amp meter coils to the load



Vital Statistics of 230-Kv Wood H-Frame Line

Length = 34.5 miles Nominal voltage = 230 kv
Type of construction = Single circuit, wood pole, braced H-frame
Structures per mile = 7.0 average
Spans: ruling = 800 ft, average = 750 ft, max = 1,595 ft
Poles = Western red cedar, class 2
Conductor = 795 MCM 45/7 ACSR
Configuration = Horizontal
Phase separation = 19.5 ft
Max conductor tension, heavy loading = 10,000 lb (43.6% ult.)
Final conductor tension, 60F = 4,240 lb (18.5% ult.)
Overhead ground wires = 2⅜-in. EHS steel with heavy zinc coating
Max ground wire tension, heavy loading = 6,250 lb (40.6% ult.)
Final ground wire tension, 60F = 3,190 lb (20.7% ult.)
Insulation = 13 units suspension; 15 units strain
Conductor swing, design = 35 deg
Clearance, conductor to ground at 35-deg swing = 69 in.
Insulation level, 4 microsec, 35-deg swing = 1,375 kv
Insulation level, 4 microsec, no swing, least impulse = 1,650 kv
Insulation level, 16 microsec, 35-deg swing = 1,085 kv
Insulation level, 60 cps, wet = 525 kv
Shielding angle, outside conductor = 31 deg
Midspan separation, conductor to static, 60F, 800 ft span = 24 ft

Wood H-Frame Shaves 230-Kv Costs

TRANSMISSION Design

Heavily braced wood structures replace steel at reduced materials and labor outlay for New York State E&G line

J. R. STOVER, Chief Electrical Engineer,

C. R. GILLETTE and **J. S. FASOLI**, Transmission Engineers, New York State Electric & Gas Corp, Binghamton, N. Y.

By using heavily braced wood H-frames instead of steel for 230-kv structures to carry a 795-MCM ACSR circuit, New York State Electric & Gas Corp realized savings in both materials and labor.

Full-scale structure tests proved the design was rugged mechanically and justified the use of special hardware at several connection joints. Subsequent ease of construction was proved when a normal crew framed as many as four tangent structures per day.

The wood H-frames constitute 35 miles of a 45-mile line connecting the company's Central System and Western Division. Although it will operate as a 115-kv tie for some years, eventually the line will form part of a planned 230-kv system.

Studies indicated that 795-MCM ACSR would be required for 115-kv operation. Fortunately, from a radio influence and corona loss standpoint, this conductor size was satisfactory for 230 kv also. The choice of stranding—45 aluminum over seven steel strands—was determined by strength and sag characteristics.

The conductor was strung so that tension would reach a maximum of 10,000 lb, or 43.6% of ultimate strength, under National Electric Safety Code heavy-loading conditions. With an additional tension limitation of 25% ultimate at 0F and final sag, vibration was not expected to be serious enough to warrant dampers. Nevertheless, preformed aluminum armor rods were installed to help reduce possible vibration and to protect the conductor from burns in event of flashover.

High strength and high corrosion resistance were the two factors governing the choice of overhead ground wires. The strength requirement was satisfied by ⅜-in. extra high strength, 7-wire steel strand, ultimate 15,400 lb. Heavy zinc coating was used throughout for corrosion resistance.

Overhead ground wires were installed so that tension would reach a maximum of 6,250 lb, or 40.6% of ultimate strength, under NESC heavy-loading con-

ditions. With the additional tension limitation of 25% ultimate at 0F and final sag, the normal or 60F final tension was 3,190 lb—about 20.7% ultimate for the 800-ft ruling span. Vibration effects were minimized by applying preformed armor rods at suspension points.

Determining the Lightning Protection Level

Calculations to determine the lightning protection level were based on a 4-μsec wave front. This is in line with accepted practice as stated in "A Method of Estimating Lightning Performance of Transmission Lines," a report of the Lightning and Insulator Subcommittee, AIEE, Transactions Vol. 69, Par II, 1950, p 1187-95. Insulator coordination was based on a swing of 35 deg as a more realistic value than the previously accepted 45-deg swing.

Thirteen insulators in series with about 8 ft of wood have a wet 4-μsec impulse value of 1,650 kv when wood is taken at 50 kv per ft. With the insulator string at 35 deg to the vertical, the air gap clearance from conductor to pole ground wire is reduced to 69 in. and a positive 4-μsec impulse value of 1,375 kv. This is still equivalent to 13 5¾ x 10-in. standard suspension insulator units on a steel structure.

For an 800-ft span and 20-ohm footing resistance, this insulation level has an outage probability of 0.7 per 100 miles per year for lightning strokes to the structure. For a shield wire separation of 24 ft in an 800-ft span, the outage probability would be 0.3 per 100 miles per year for strokes to midspan. The average of these two probabilities is 0.5 per 100 miles per year for this line. This data is based on the committee report mentioned.

To evaluate the proper protection level against flashovers caused by switching surges and 60-cps wet conditions, generally accepted factors were applied to the rated phase-to-ground voltage. This resulted in a critical impulse level of 1,020 kv and a 60-cps wet flashover level of 445 kv. A string of 11 5¾ x 10-in. suspension insulator units would have provided this protection.

The 13-insulator string provides two extra units—one to reduce hazards of hot-line maintenance, and the other to guard against string failure due to a defective unit. This provides critical impulse flashover of 1,185 kv and a 60-cps wet flashover of 525 kv. As the insulator string swings to 35 deg with the vertical, the air gap is reduced and the level falls to 1,100 kv—still somewhat above the minimum critical impulse of 1,020 kv established above.

Design of the tangent structures was based on the company's excellent operating experience with 115-kv wood H-frame lines. This prompted an investigation of the possibility of increasing clearances and mechanical strength and adapting this design to 230-kv.

Simplicity dictated the selection of a single-arm tangent structure both X-braced and knee-braced for rigidity. Particular attention was given to design of the joints. Various loadings were assumed, and all forces acting at the several connection points were determined. Then the joints were designed so they could most effectively resist these forces.

Effectiveness of all connections to withstand slippage and deflection under loading was extremely vital to the success of this type of construction. Therefore spiked grids, curved grid plates, and shear plates were incorporated into various bolted connections.

The entire H-frame design was based on the availability of Douglas fir timbers in 40-ft lengths and adequate quality. Crossarms were bought several months before actual requirement, incised, and allowed to season in a rough sawn state until shortly before use. Then they were hit-or-miss surfaced to 7¾ x 7¾ in., drilled, and pressure-treated with a 5% solution of pentachlorophenol with a final retention of 6 lb per cu ft.

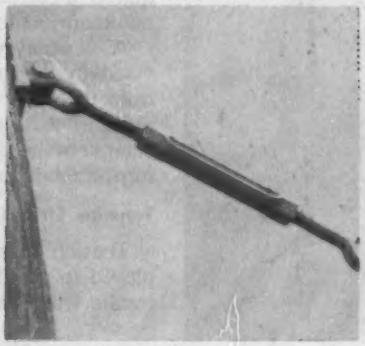
Tension-type knee braces similar to wood strain insulators were used in both external and internal positions. Loading characteristics of the braces were determined from a stress analysis of the individual members of the truss formed by the crossarm, knee braces, and pole tops. The analysis showed that under loading both external braces were always in tension, one internal brace was in tension, and the other internal brace was under a relatively light compression load that could be carried readily by a brace of the same type as the tension members.

Destruction Test Checked the Design

To check the design features of this framing under actual load conditions, a full-scale structure top was tested to destruction. Objective was to determine:

CURVED GRID PLATES resist vertical components of loads transmitted by external and internal knee braces

TURN BUCKLES in series with external knee braces allow adjustments to take slack out of the bolted connections



KNEE BRACE ASSEMBLIES at the crossarm support insulator suspension strings. Outside phase is shown here

1. The feasibility of using a single timber crossarm for 230-kv construction and the effect of eccentric arm-and-brace loading on various connections and component wood members.

2. The desirability of using external and internal wood strain-type knee braces and of pre-stressing, through use of turnbuckles, the external braces from poles to outside phase support positions.

3. The holding capacity of spike grid connectors between the crossarm and the poles.

4. The load-carrying ability of curved grid plates and shear plates at various bolted connections.

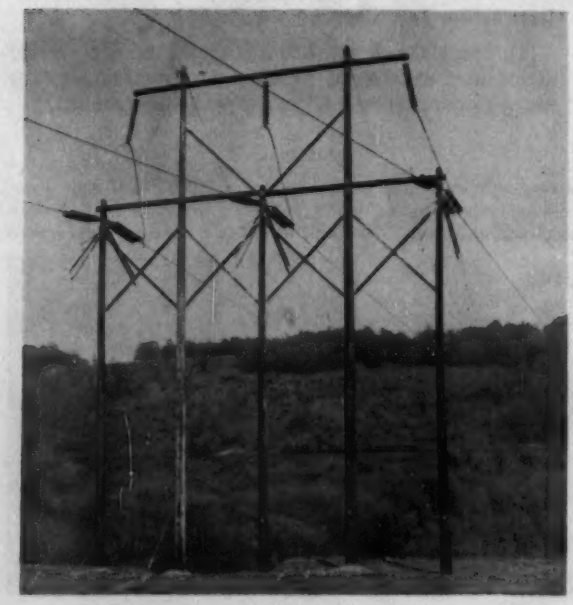
Examination of each bolted connection after the test revealed remarkable resistance to slippage, ranging from no slippage at most connections to a 1⅞-in. maximum at one crossarm-through-bolt location. This was after the structure had been subjected to 6,000-lb vertical load at each conductor position and 14,000-lb transverse load. Failure occurred at this loading—the equivalent of 8½ lb per sq ft of wind on 1½ in. of radial ice on a 1,000-ft span.

Use of 7¾ x 7¾-in., 40-ft single timber fir crossarms with bracing from pole sides to arm top proved satisfactory. But the heavy vertical and transverse loading of this structure produced some bowing of the arm. This loading also introduced torsional stresses which tended to rotate the bottom face of the crossarm away from the pole. Undoubtedly this was due to the eccentric load which the bracing put on the arm. But even the heaviest loading did not seem to have an unfavorable over-all effect on the structure.

Wood Tension Braces Proved Effectiveness

The wood strain-insulator-type tension braces proved their effectiveness during the tests. Through use of turnbuckles to pre-stress the external braces, 6,000 lb was supported at each conductor position. This loading caused less than 3-in. deflection at the ends of the crossarm. During field construction the braces were prestressed even more intensely—so that the ends of the crossarm were bowed upward about 1 in. at each end.

TANGENT-TYPE DEADEND, consisting of 5 poles on 12-ft centers, serves as long-span structure and terminal deadend



For normal conductor spans, pole and conductor spacings are both 19½ ft. A ground wire was carried down each pole and terminated on a copper plate fastened to the pole butt. All pole attachment hardware is bonded to the ground wire, and a pole-to-pole bond was made about 2 ft below the earth's surface. A galvanized steel channel between pole tops serves as the shield wire support and electrical tie.

Two Structure Types Designed for Line Angles

Two types of 3-pole suspension structures were used at line angles. One type, used on 8-to-20-deg angles, has pole-and-conductor spacing of 20½ ft. It makes use of brackets bolted to each pole to support the suspension insulator strings and maintain proper clearance.

The other type, used for 20-to-45 deg angles, has 21½-ft spacing between poles and conductors. Each suspension insulator string was attached directly to the pole through a heavy-duty band and yoke arrangement. All angles suspension structures are X-braced and guyed according to individual requirements.

Two types of 3-pole angle deadend structures were used. Both incorporated the same general design, with positions to dead-end three conductors and two overhead ground wires in both directions. Both structures used jumper suspension insulator strings to maintain proper clearances.

One type of deadend, used for angles from 20 to 60 deg, has a pole spacing of 22½ ft. The other type was designed with a spacing of 27½ ft for angles from 60 to 90 deg.

A tangent-type deadend consisting of five poles on 12-ft centers serves both as a long span structure and terminal deadend. In its function as a long span deadend it is line-guyed in both directions. However, on reduced tension installations line guys were installed against the higher tension only. The required electrical clearances to jumpers were maintained by suspension insulator strings attached to a crossarm mounted directly above the conductor deadend positions.

Conductor hold-down weights were attached to the clamps at locations where the weight of the equivalent vertical span of conductor would not be sufficient to keep the insulator string from swinging beyond 35 deg. Calculations showed that the maximum weight required to correct this condition would be 350 lb and the minimum 50 lb.

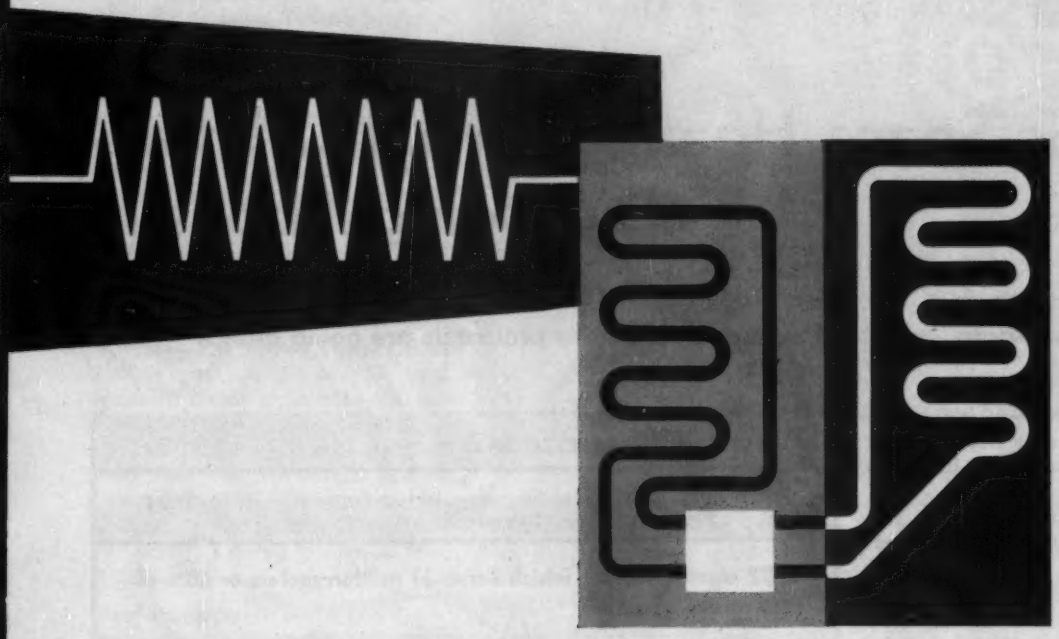
A flexible system of hold-down weights was provided by designing a 50-lb galvanized-cast-iron pancake that was 11-in. in dia and 2-in. thick. One to seven of these weights were attached to the conductor clamp by a hook-bolt-and-shackle arrangement to furnish the required weight under individual conditions.

Tension Stringing Protected Conductors

Tension stringing of the three conductors was employed to avoid the scoring and abrading that usually results from conventional methods. These nicks and

(Continued on page 136)

A SPECIAL REPORT:



Electric Space Heating:

How Soon for You?

Probably much quicker than expected, say speakers at EW Conference. Reasons: Spreading summer peaks, need for big wintertime load

Beginning on the next page with a survey of current industry activity, Electrical World brings you a complete 15-page report of its Electric Space Heating and Heat Pump Conference held last month in New York. In it you will find the latest data, facts, and opinions as presented by some of today's leading authorities in the heat pump and resistance heating fields.

Purpose of the two-day meeting was to bring into better focus the marketing, rate, and service problems utilities now or will face as the space heating load grows in significance. And it will. The speakers left no doubt about that. It is hoped the material which follows will be as helpful to you as we have been told it was to the 190 folks who attended our meeting.

Fischer Black

Electric Space Heating: What Utilities Are Doing About It

Mushrooming interest revealed by new Electrical World survey. Here's an up-to-date look at the market and how the promoters are going after it

At least 25,000 to 30,000 homes completely heated by electricity will be hooked up to utility lines this year.

At the same time 12,000 to 13,000 new heat pump units will go into operation. This will about double the number there are now.

These are the conclusions of an industry survey just compiled by Electrical World.

Based on figures supplied by those answering the survey (see box) and expanded to include the nation, there were 250,000 homes completely equipped with electric resistance heating at the end of 1956. More than half are in Tennessee.

In 1957 those surveyed will add about 20,000. Expanded to cover the country, this could easily run as high as 30,000 homes—a gain of 13% over last year. And it will represent a little less than 3% of the total housing units built.

Added to this is the commercial market. At the end of 1956 there were 18,000 commercial establishments completely heated by electricity. This will rise by 2,500 in 1957.

Thus 12 months from now there should be conservatively 300,000 homes and commercial buildings served entirely by electric resistance heating. Investor-owned power companies will have about 104,000 of them on their lines—roughly one-third of the total. The remainder will be served by public agencies, municipals, electric cooperatives.

Among power companies, the old idea that electric house heating is confined to the South doesn't hold, the survey shows. It is the highly-saturated Tennessee market that puts the South on top. But volume of electric resistance heating between Northern and Southern power companies is about the same.

At the end of 1956, the companies surveyed above and below the 4,000 degree day line were serving about 40,000 homes and buildings each. But the North's rate of growth is running faster—about one-third faster. In 1957 the Northern companies say they will add 9,000 to the Southern companies 6,000.

Power companies with the largest number of electrically heated homes and buildings right now are Southern Nevada Power Co with 18,600, Pacific Gas & Electric Co with 10,000, Washington Water Power Co with 7,500 and American Gas & Electric Co with nearly the same. Other companies now with

Who Promotes?

The Survey Covered:

137 electric utilities which serve 31 million meters or 60% of the nation's total

Of These:

100 are investor-owned electric companies
37 are large municipal systems, electric cooperatives, public power districts

Of the 100 Power Companies:

27% now promote electric resistance equipment for complete space heating
15% more either plan to do so in 1957 or are considering it
41% now promote heat pumps
17% more either plan to do so in 1957 or are considering it

Of the 37 Municipals and Cooperatives:

57% now promote complete resistance heating
19% more either plan to do so in 1957 or are considering it
36% now promote heat pumps
27% more either plan to do so in 1957 or are considering it

1,000 or more homes include Puget Sound Power & Light, Atlantic City Electric, Alabama Power, Southern California Edison, Tampa Electric and California-Pacific Utilities.

Puget Sound Power & Light, which won't begin active promotion until next year, has more than 4,500 homes and hopes to add 1,700 more in 1957 in spite of the intrusion of natural gas in its area. Even Long Island Lighting Co, a non-promoting combination utility, estimates it has 900 all-electrically heated homes. Heaviest saturation rests with Southern Nevada Power Co. at Las Vegas. With 30,000 total meters it claims to have 18,600 all-electrically heated homes and commercial buildings. It will add 900 more this year. Its electric heating saturation: 60%. Its average residential consumption: 9,600 kwhr per year. Its lowest residential rate: 6 mills.

Heat Pump Sales

Utilities surveyed had 11,000 heat pump units in use at the end of 1956. More than half of them were sold in the past 12 months. About 60% of them are in homes, 40% in commercial buildings.

Sales, they said, will nearly double this number again this year with total units in use jumping to nearly 21,000. Projected to include the entire nation, there could be 24,000 to 25,000 heat pump units in operation by the end of 1957.

Power companies seem to have a much larger share of the heat pump market than they do of the resistance heating market. They will have some 90% of the heat pumps on their lines at year's end. And of this share the straight electrics will serve all but 20%.

The South, even though it is losing its dominance of resistance heating, still seems to be undisputed champ when it comes to heat pumps. The survey shows there are fully 3½ times as many heat pumps served by power companies below the 4,000 degree-day line as there are above it (8,000 units vs 2,250), and this ratio will remain the same this year (15,000 vs 4,500).

Florida Power Corp has far and away the most heat pumps on its lines—more than 3,700 and it expects to add that many more in 1957. (This includes both central units and reverse cycle room air conditioners.) Pacific Gas & Electric Co has nearly 1,000; the American Gas & Electric Co group 600. Alabama Power, Tampa Electric, Georgia Power, Gulf States Utilities, and Southern California Edison Cos each have 300 or more heat pumps in service. Only two of these —PG&E and AG&E companies— are anywhere above the 4,000 degree day line. What is more, in these eight leading companies is concentrated more than 65% of all the heat pumps in the country. Yet 41 of the 100 power companies in the study said they promote.

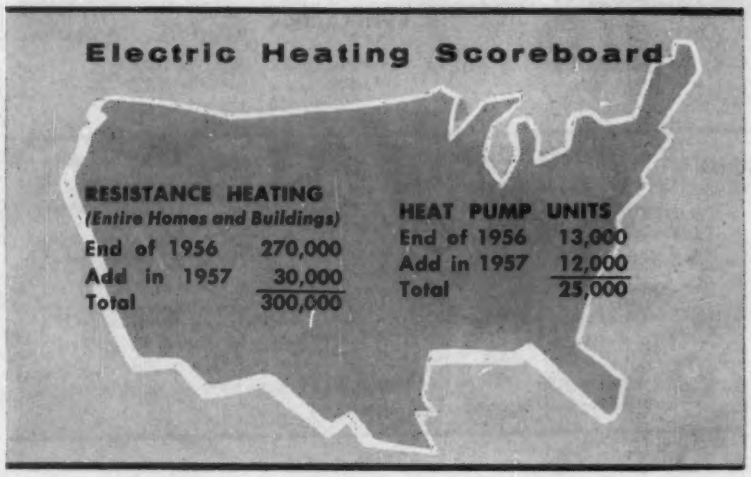
As to be expected, the study found that it is pretty much the same group that promotes resistance heating that promotes the heat pump. But with one notable exception: The Southern company which still has a winter peak—companies like Florida Power and Tampa Electric—and/or one that feels local competitive fuel rates are too tough to buck. It puts all its promotional weight behind the heat pump. In spite of this, both Florida Power and Tampa serve large blocks of resistance heating.

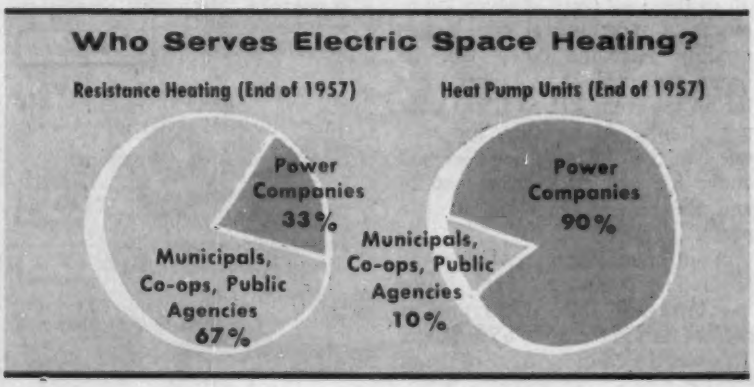
Anatomy of the Heat Promoter

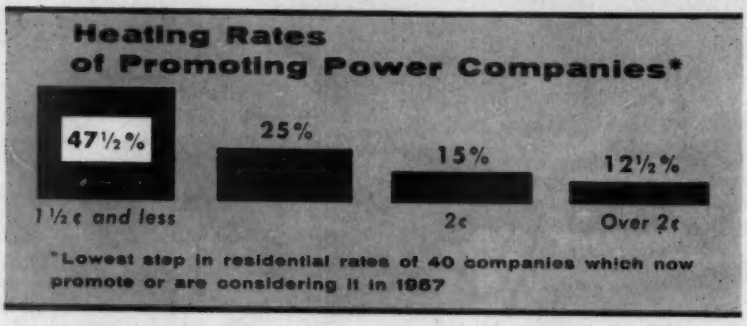
What is the nature of the power company which promotes or plans to promote electric heating?

The study shows it is most likely a straight electric company (only eight of the 42 were "combinations"), and it isn't particularly confined to the South. There are nearly as many utilities above the 4,000 degree day line which do or will promote it as there are in the South (43% vs 57%.)

What is more, there is a slightly better chance that this utility still has a winter peak rather than a summer one (55% vs 42%). It is to be expected, however, that the winter peak companies are anticipating summer peaks, and/or trying




Who Serves Electric Space Heating?
Resistance Heating (End of 1957)
Power Companies 33%
Municipals, Co-ops, Public Agencies 67%
Heat Pump Units (End of 1957)
Power Companies 90%
Municipals, Co-ops, Public Agencies 10%



to meet a competitive situation in their efforts to promote the all-electric home.

The heat promoting company definitely competes with other fuels, the study shows. Most (86%) compete with natural gas heating, and more than half compete with No. 2 fuel oil. Of those who stated their competitors' rates the majority (55%) were selling against natural gas in the 50 to 70¢ per mcf and against fuel oil in the 14 to 16¢ per gal range. Twenty-eight percent were selling against gas over 70¢ and 17% against gas at less than 50¢. A few competed with fuel oil as low as 13¢ per gal.

The promoting company's own electric rates for house heating fall below 2¢ a kwhr—72½% of the 40 which supplied rate information did. And nearly one-half were 1½¢ and below. However, 15% are promoting it at 2¢ and 12½% even between 2 and 2½¢. Some 25% sell at rates between 1.6 and 1.9¢.

The promoting company does not have a demand charge. Only one-third of those studied do, and all of these set them at seven kw or more. A most liberal one is that used by Alabama Power Co. Its urban rates are set at 1¢ per kwhr for all use from 201 to 1,300 kwhr per month. Above this, for each one-half kw of recorded demand above 8.5 kw, 70 kwhr are at 2¢ and the remainder is billed at a penny again.

Also, chances are best that the promoting company's load factor has increased since 1950 and at present falls in the 55 to 65% range. This was the case, for 62% of them.

Companies with winter peaks generally had higher load factors than those with summer peaks. There were more than twice as many promoting winter companies in the study with load factors above 60% as there were summer companies. At the same time, all but two of the 15 companies with decreasing load factors have summer peaks. A few of these summer peak companies registered drops as much as 10% over the past six years.

How They Promote

How do the 27 power companies already engaged in heat promotion go about it? The box on page 75 lists what are considered to be the basic elements of a good heating program, and the extent to which the heat promoters use them.

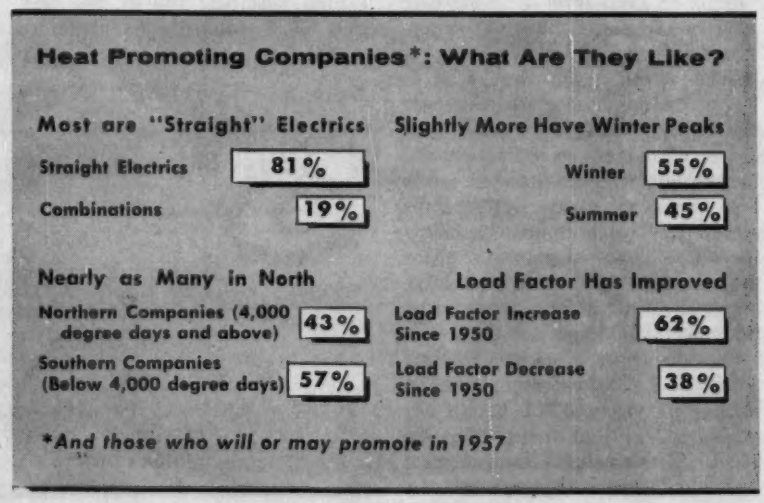
In regard to insulation standards the majority try to get rockwool or its equivalent—6 in. overhead, 4 in. wall and 2 in. floor, although some in the South will go 4 in. on the ceiling and 2 in. on the walls. A good many also require storm doors and windows.

Most of the companies insisted they can't actively enforce these standards, but some try to sell it by education and by selling operating economy to the homeowner. A few, including Cleveland Electric Illuminating Co, use an actual field check. This is highly favored in the public power areas.

Budget billing is a leaf they have taken from the gas industry's book. Most of these plans spread payments in even amounts usually over ten months between September and June. Some companies even purposely try to overestimate payments so the customer will have a refund coming in the spring when the account is settled. Good public relations, they say.

To calculate heat loss and estimate operating costs, the promoters seem to use the ASHAE guide most. Other methods widely used are the newly released NEMA guide, and individual heater manufacturer's catalogs. Great majority of them (82%) recommend a thermostat in each room although less than half of them limit thermostat circuits to any particular capacity. Five kw is by far most popular with those which do.

In their choice of media for heat


Heat Promoting Companies*: What Are They Like?
Most are "Straight" Electrics
Straight Electrics 81%
Combinations 19%
Slightly More Have Winter Peaks
Winter 55%
Summer 45%
Nearly as Many in North
Northern Companies (4,000 degree days and above) 43%
Southern Companies (Below 4,000 degree days) 57%
Load Factor Has Improved
Load Factor Increase Since 1950 62%
Load Factor Decrease Since 1950 38%
*And those who will or may promote in 1957

promotion, the majority (88%) rely on personal calls, handout literature and floor displays in their own stores and offices. These methods are followed in use by newspaper advertising (74%), direct mail pieces (70%) and the new NEMA slide film (56%). Radio and television are used by 26%, and a few even use truck cards, car cards, or billboards.

Bulk of the heating equipment business in the heat promoting areas is done by the electrical contractor or the specialty salesman. And companies are evenly split over which of the two they think is best qualified to sell it. But even a lot of those which picked the electrical contractor had reservations about it. They doubted his ability and willingness to sell—an old problem utilities have run into before in selling wiring and lighting.

A couple of companies came up with another kind of selling twist. They say the storm door and insulation dealer is the best man to sell heating. Their reasoning: Electric heating goes hand in hand and helps to sell his other merchandise.

Media used by the 41 heat pump promoters follows much the same pattern as that used for resistance heating. Most popular are handout literature (93%), personal calls (90%), and newspaper advertising (73%). However, there seemed to be a slightly wider use of radio and TV (34%). Another favorite device is the heat pump display. A great many of them install them to heat and cool their own buildings and open them to inspection.

The heat promoters also seem to recognize the value of working with the architect. Eighty-five per cent do. They rely mainly on regular personal calls to reach him, but the more aggressive ones augment this with direct mail pieces and by furnishing specification sheets. Some provide layouts for custom jobs, others hold meetings and special schools for architects and contractors, and a few issue operating reports of heat pump installations.

The survey also revealed some things about the power companies which don't promote heating. Three-fourths of the 58 companies which said they don't and have no plans to promote heating are in the North. And nearly that many (72%) have winter peaks. More than half of the non-promoters participating in the survey were straight electrics.

Two Missouri companies, both in the summer heat storm area and both with summer peaks, are experimenting with their rates right now in an attempt to come up with something competitive. St. Joseph Light & Power Co offers all kwhr used for heating at 1¾¢ plus fuel adjustment as a supplement to its standard low step of 2.2¢. Empire District Electric Co in Joplin plans to make available shortly a rate tied to summer kwhr at 1¼¢ if sufficient air conditioning is used in the summer. Its present low residential rate is 2¼¢.

How Promoting Companies Run Heating Programs

More than ¾ths of them . . .

- Work with the trade
- Adopt definite policies to guide employees, the trade, and the public
- Have a department or individual specifically assigned to handle heating
- Make load studies of resistance heating on their systems
- Maintain or recommend standards on insulation of electric heating jobs

More than ⅔rds of them . . .

- Furnish layout service for electric heating installations
- Provide budget billing plans for their customers

Municipals, Cooperatives

What about the municipally owned electric systems and electric cooperatives?

As a group they have been more active in electric resistance heat promotion than the power companies.

The City of Chattanooga has the largest single concentration of completely electric resistance heated homes in America. At the end of the year it will have more than 25,000 on its lines (36% saturation) and through continued promotion expects to add 3,000 more next year. Knoxville serves more than 16,000.

Other large municipals with more than 1,000 homes include Seattle City Light, Tacoma City Light, Memphis Light, Gas, and Water Division and Sacramento Municipal Utility District. Salt River Power District also tops the 1,000 mark.

Electric cooperatives which boast 500 or more homes: Gibson County and Cumberland County Electric Membership Corps (both Tennessee), Inland Power & Light Co (Washington), Pedernales Electric Cooperative (Texas) Warren REC (Kentucky) and West Kentucky REC. Yet not one of them has more than 21,000 total customers.

Tennessee-Kentucky, the Pacific Northwest, and parts of the Southwest accounted for most of the electric heating. But promotion is being pushed by cooperatives as far north as upper Michigan, Minnesota, and Wisconsin.

The promoters' lowest residential rates vary from a high of 2¢ per kwhr to a low of 4 mills, with the lowest ones being offered by the Tennessee power suppliers. Nearly ¾ths of them had heating rates at 1½¢ or less. Only 38% of promoting municipals and cooperatives were found to have summer peaks, and all but two of those who do are below 4,000 degree days.

Municipals, electric cooperatives, and other government agencies do not dominate the heat pump market as they do resistance heating. While they serve ⅔rds of resistance load for complete heating, they serve but 10% of the nation's heat pumps. One good reason for this: The small demand for summer cooling in Tennessee and the Pacific Northwest. Another: The desire of many cooperatives to keep hot weather use down because of already high demands for irrigation pumping.

Summer Peaks: What to do?

". . . the only answer is the all-electric home which includes space heating . . ."

GORDON W. EVANS,
Chairman of the Board and President,
Kansas Gas & Electric Co, Wichita, Kan.

Until three years ago the annual load factor of Kansas Gas & Electric Co was excellent. Our load was very well balanced as between winter and summer peaks. The winter peak was slightly ahead of the previous summer peak.

The year 1953 started a new trend with the summer peak 3,000 kw higher than the winter peak. Then in 1954 the difference was 42,000 kw or 16%; in 1955 it was 50,000 kw or 18%, and this year it will be about 80,000 kw or 25%.

As our investment in power equipment is about $300 per kw, this means that $24 million in facilities is not being used eight or nine months out of the year. At 12% this is $2,880,000 per year or $240,000 per month for fixed charges (interest, taxes, and depreciation). Certainly with this amount of fixed charges being paid for in a company with only $30 million in annual operating revenues, we must do everything possible to add profitable business in other months.

About 25% of our summer load is subject to hot weather.

Declining Load Factor

We have checked some distribution feeders with a high saturation of air conditioning. On a hot day there is about 6 kw diversified demand per customer. In fall and winter this drops to about 1½ kw. So the problem definitely extends from the power plant through the distribution facilities.

This problem can be stated another way by taking a look at our annual system load factor. In 1953 load factor was 65 (with peak loads about the same in summer and winter). In 1954 it was 59; in 1955, 57; and in 1956, 55.

This decrease of 10 points in load factor in 4 years is not too good; however, it is still a very fine annual load factor, and we expect to change this downward trend.

The problem can be stated a number of ways, but it simply means that we must find a way to improve our load factor and thus improve net earnings, without rate increases if possible.

We think our company is not unique and that some of the rest of you will have it sooner or later. Remember air conditioning can be most effective in removing humidity as well as heat. Any area with relatively low temperatures in summer but with high humidity will turn more and more to air conditioning. And then, you are faced with the problem. It is one too big for the normal accepted electric appliances to solve. The only answer is the "all-electric home"—which includes electric space heating.

Once we concluded that electric space heating was the answer, rates had to be set. It was our opinion that special consideration, in some form, should be given to sales for electric heating. It is our idea that rates must be compensatory—cover all the cost of service and include a profit. They also must be simple and understandable to the customer. In addition they should approach competitive costs—they need not be so cheap as others—but they must have features that will allow us to compete with other fuel types.

We have a hybrid residential rate, with a so-called "floating block" for cooking, for water heating, and for cooking and water heating together, all at 1¢. I am not recommending this type of rate, but we had it and we felt we had to live with it for the time being.

1.5¢ Heating Rate

In Wichita, after the first two steps (3.5¢ and 2.5¢) and the 1¢ floating block, previously referred to, we have 600 kwhr at 1.5¢ and the excess at 1.8¢. To meet the space heating question we added a clause to our rate which in effect states: "When permanently installed space heating equipment is in regular use to supply the entire heating requirements in the home, the last block of the rate shall be 1.5¢ per kwhr during the winter season." This in effect makes all use over 200 kwhr in the winter at 1.5¢ for customers without ranges and water heaters. We feel that during the off-peak winter season, 1.5¢ is fully compensatory.

The question has been raised—suppose we go back to a winter peak—wonderful. That's what we are working for. Our load factor goes back up to 65+, the customer's annual use will be skyhigh, and perhaps we can afford to sell it at 1.5¢ the year around.

It is our opinion that the public is ready for electric heating. The question is "are the utility companies ready to sell it." We believe that the public is ahead of the electric utilities in this.

Why Electric Heating?

". . . only way industry ever will realize 10,000 kwhr per customer . . ."

PAUL D BROOKS,
Vice President,
American Gas & Electric
Service Corp, New York, N. Y.

We are not being 100% honest with ourselves when we talk about the all-electric home or commercial establishment when the heating and/or cooling is supplied by some other fuel. The all-electric living idea cannot become a reality until electric resistance heating and year-round air conditioning with the heat pump is adopted by our industry and made a part of the Live Better Electrically program.

Our interest in the heat pump began more than 20 years ago. Up to (the postwar period) we thought of (an all-electric) home as one in which the customer used an electric range, refrigerator, electric water heater, and lighting and miscellaneous appliances. It became evident to us that the domestic market was broader than this and that competition was going to be very keen. In order to meet competition effectively and to capture and hold the residential market, we decided we would have to find a way to heat homes electrically with economy to both our customers and ourselves.

The heat pump was not the answer for the mass home market, and by mass market we mean homes in the $11,000 to perhaps $18,000 price range.

Resistance Heating, Too

Our program embraces not only the heat pump but also resistance home heating and air conditioning. It was undertaken likewise for commercial and industrial users and on the basis of existing rates.

Our system covers several temperature zones with degree days of about 3,500 to 6,500. In our opinion degree days from either a heating or cooling standpoint should not influence your decision in whether or not you should promote.

By the end of 1956 we expect to have somewhere near 800 heat pumps installed or in the process of being installed on our system. These installations will be fairly well divided between residential and commercial.

There is a market (for commercial heat pumps)—and a very important market from a revenue standpoint. Records show that we can expect an annual revenue of about $50 per hp of installed heat pump compressor load. Compare that revenue per hp with some of your other commercial loads. And then consider that in every case we have investigated, the heat pump has considerably improved the annual load factor over that obtained with a fuel-fired heating and electric summer cooling system.

The average of 4,906 residential heat pump and resistance heating customers billed for 12 months ended October, 1956, used 19,382 kwhr per year and paid us a total annual electric bill of $293. Contrast this with our system residential customer average use of 3,291 kwhr per year. Heating customers therefore raise our average use 69 kwhr per customer and revenue 92¢ per customer. I submit that only through the sale of heat pumps and electric home heating will our industry ever realize its much publicized goal of 10,000 kwhr use per average customer.

What about the future of electric heating and the heat pump? We expect to have a 25% saturation of resistance heating and heat pumps by 1975—and in view of the fact that we expect to be serving 2 million residential customers by that time means we will have 500,000 heating and year-round air conditioning customers. Breaking that figure down means a 10% saturation of heat pumps and a 15% saturation of resistance heating.

Salesman's Viewpoint

To tell how electric space heating is being sold successfully in low-cost natural gas territories, Brooks introduced Ben Thomas, heating and building sales representative of Appalachian Electric Power Co, Point Pleasant, W. Va. Said Thomas:

Our district of 10,600 customers now has 75 electric home heating installations. Less than 1½ years ago we had four. Approximately 50% of the installations have been installed in existing homes ranging in age from 1 to 30 years.

Our dealer had a small insulation business prior to taking on electric heating. At the time he was approached by our company he was not overly impressed. However, he figured if he sold only three or four jobs a year, it would be just that many more insulation jobs. Well, he sold those four jobs and has sold many more. Electric heating is now his bread and butter. The insulation and storm windows are now carried only as a part of the material required for a good installation.

How NEMA Views the Market

HEATING EQUIPMENT MAKERS: Ceilheat's Goff (left), Wiegand's Kreiser, NEMA's J. F. Miller, Electromode's Mast, Berko's Aronson, and Cavalier's Wessel

Excerpts of special presentation by Electric House Heating Equipment Section of National Electrical Manufacturers Association follow on this page and top of the next:

"77.6 billion kwhr in heating sales by 1970"

STANLEY B. ARONSON, Sales Manager, Berko Electric Manufacturing Corp, Queens Village, N. Y.

Figures reported to NEMA show that in 1954, 316,000 kw of electric space heating were sold. (This includes complete space heating plus supplementary and auxiliary, but not heat pumps or portable heaters.) In 1955, 405,000 kw were sold. This represents an increase of 28%. As of the end of September 1956, 320,000 kw had been reported sold. Projecting this we find that we can expect 549,000 kw to be sold in 1956.

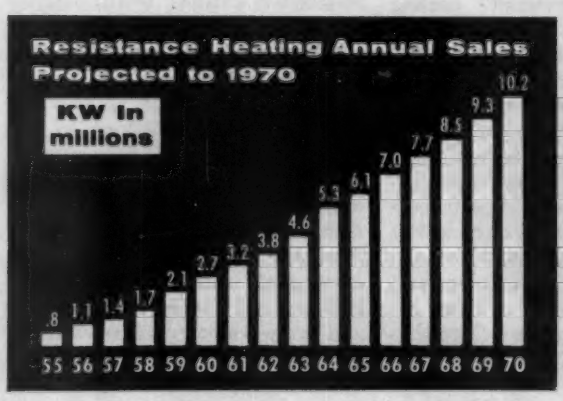
However, because there are many manufacturers who are not members, no more than 50% of the electric heating sales are reported to NEMA.

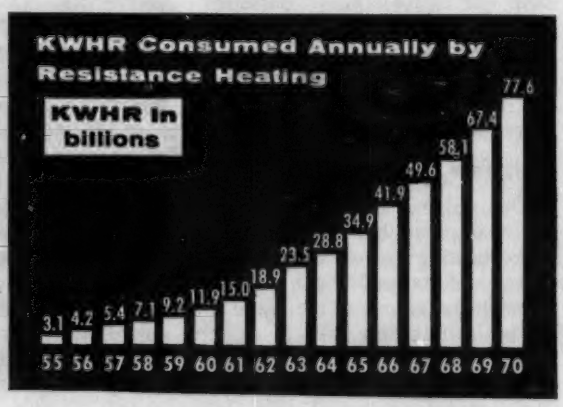
Charts below show projected total industry electric heating sales through 1970. Sales have been increasing at a little bit over 30% per year. But for these projections, we have assumed that in 1957 through 1960 sales will increase only 25%, that in 1961 through 1963 they will rise but 20%, 1964 through 1966 by 15%, and from 1967 to 1970 only 10%.

"Serve 2 or 3 users instead of one with same connected load"

JAMES E. GOFF, Vice President, Ceilheat, Inc, Knoxville, Tenn.

Insulation is the base on which our industry rests today. A house can be insulated to where it requires only ⅓ the heat of an uninsulated house, and even the NEMA minimum recommendations reduce the heating to ½ of the insulated house. Insulation means that you can serve two or even three satisfied customers with the same connected load as one unhappy customer. In addition, the diversity between more thermostatically controlled units reduces a utility's net demand.





"Electrical heating of schools: Big savings for taxpayer"

C. F. KREISER, General Sales Manager, Edwin L. Wiegand Co, Pittsburgh, Pa.

Electric heating of schools is one of the newest markets to capture public and utility interest. This load comes on primarily in the night or early morning hours and does not aggravate any normal peak. Hence it helps sell substantial kwhr and improve load factors.

But the big story on electric school heating is in the savings for the people who foot the bill—the taxpayers. For the lower initial cost of electric heating is impressive. In a typical 30-classroom school, about $100,000 savings can be realized—in avoiding such mechanical and architectural items as chimneys, pipe trenches, boiler room, fuel storage areas, boilers and controls, valves and piping, and standby boilers.

As school bond issues are repaid over periods of 20 to 30 years, another $100,000 can be saved on the financing costs of the extra $100,000 that would otherwise be paid for the higher-priced conventional system. This means, in reality, a saving of $200,000 for the school board and taxpayers. Savings in first cost can pay any higher operating costs for years ahead.

"Auxiliary, supplementary uses represent 80% of market"

LOWELL R. MAST, Director of Engineering, Electromode Division, Commercial Controls Corp, Rochester, N. Y.

Complete heating will continue to grow. However, the complete heating market represents only a small part of today's potential market. The auxiliary and supplementary uses of electric space heating represent in my opinion about 80% of the market. I believe it will maintain this ratio for the next few years. The market for heater applications that fall within the auxiliary and supplementary applications stagger the imagination. Every modern home, commercial, and industrial establishment in the United States is a prospect.

Auxiliary and supplemental heaters develop loads that most any utility can serve without difficulty. It is my opinion that utilities favoring electric heat to any degree should establish a department . . . specializing in electric space heating applications to serve its customers by assisting distributors and contractors.

". . . no installation removed where properly sold, installed"

MELVIN H. WESSEL, Sales Manager, Electric Heating Division, Cavalier Corp, Chattanooga, Tenn.

In some areas of the country today 95% of all new house construction has electric heat installed. We know of no installation of electric heating being removed where it was properly sold and properly installed. We of NEMA estimate that a million houses will be heated electrically by 1960 and three million houses ten years from now.

When and Why? . . . Industry Leaders Speak

". . . 37 million more hp of cooling load by '63 . . ."

GEORGE S. JONES, Managing Director, Air Conditioning & Refrigeration Institute, Washington, D. C.

The impact of air conditioning on all phases of our economy is no longer a problem of the future. It is a problem of today.

The greatest electrical output for any (summer) week in the history of this electric age was generated and used during the week ended last Aug. 18, an output which was 10% above the top week of the preceding summer. But of even greater significance, it was above the previous record (winter) high. And for the first time in history, our national summer peak exceeded the winter peak.

As manufacturers of air conditioning equipment, we recognize that many of the problems are ours, and ours alone, to solve. These include providing a better power factor, extending use of our equipment on both ends of what we have come to accept as the "cooling season," reducing the cost both of equipment and installations, and improving the efficiency of equipment, with particular emphasis on reducing the spread between starting current and running current.

In 1944 about 116,000 hp were added to the utility load by air conditioning. In 1956 twelve years later, the total horsepower added approximated 3 and ¾ million—more than 32 times as much.

As to the future, I'll stick with the prediction of 6 million hp added in 1963 which, added to previous increases, will put 37 million more hp on the line seven years from now (to be served over and above) the peak kwhr output of 11.749 billion reported by EEI during the week ended last Aug. 18.

There is no slacking off of the upward curve in sight—in fact, the climb looks steeper ahead than the grade we've been coming up so far.

People are going to demand air conditioning where they work and where they shop. I doubt very seriously whether the federal government will ever build another office building anywhere in this country without air conditioning. How long do we think the modern family will permit their home to be the only space they frequent which doesn't offer them air conditioned comfort?

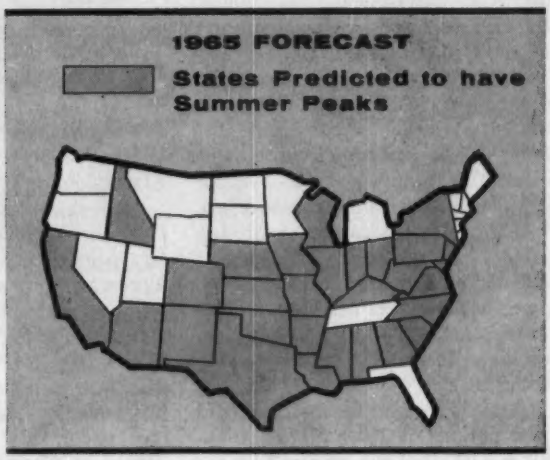
"Summer peaks in 30 states by 1965 . . . will yours be among them?"

M. R. RODGER,
Senior Marketing Consultant,
Middle West Service Corp,
Chicago, Ill.

As consultants to the Large Lamp Department of the General Electric Co, the Middle West Service Corp in November 1955 conducted a load survey of electric power systems. Purpose was to determine the companies and areas which have system peaks occurring in summer months as well as to establish any trends in the future as to season in which system peaks will occur.

Every power producer of appreciable size in the U. S. was sent a questionnaire. Response was overwhelming. We received 282 replies—197 from companies and 85 from municipal systems and government power projects. This accounted for over 95% of the total industry load.

Based on trends of summer and winter non-coincident peaks for each state and on predictions made by individual companies within those states, we predict that utilities representing approximately 71% of the total industry load in 1965 will have system peaks in summer. As shown on the accompanying map, 30 states by then will have non-coincident summer peaks: Alabama, Arizona, Arkansas, California, Colorado, Delaware, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Missouri, Nebraska, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Texas, Virginia, West Virginia, and Wisconsin. They represent approximately 78% of the total electric customers. Tennessee and Florida will maintain winter peaks.



In 1952, the South Central region enjoyed a 60.6% load factor. In 1955, after public acceptance for air conditioning had become greater, the load factor was 58.5%—a drop of 2.1% in three years. In the same three-year period, the total continental U. S. gained 1.4% in load factor.

". . . Unbiased study recommended we promote heating and heat pump"

TOM D. FULFORD,
Vice President,
Virginia Electric & Power Co,
Richmond, Va.

Prior to 1956, our company had a negative attitude toward electric space heating although we were willing to accept the idea of the heat pump. Policy was to discourage installations of electric space heating; however, we were rendering service as requested with little or no effort to retard or stimulate its growth.

To get an unbiased opinion, we engaged Ebasco Services, Inc, to make a thorough investigation of this business. In January, we changed our policy upon the following conclusions:

1. If our system peak changed from winter to summer, as the growth in cooling load indicated, the winter generating and transmission capacity would more than carry the probable additions of space heating loads. Even for the next few years, estimated new heating loads would not require increase in planned generating capacities.

2. At the distribution system level, revenues from space heating loads were at least commensurate with costs of reinforcement required to serve this load.

3. Even with the relatively low annual load factor of electric heating, its diversity with the growing air cooling loads should improve the efficiency of utilization of power supply facilities.

4. This form of home heating has grown and will continue to grow. Despite some customer complaints, it has received overall customer acceptance.

5. On the basis of annual operating cost, electric heating is fairly competitive with other forms of heating when equipment is properly installed.

6. Individual annual load factors averaged about 15%. Newer installations will produce about 13.5 kw of max demand. This is the total house load. The annual load factor based upon coincident demand is about 25%. The peak load comes between 7 and 8 AM. The load at the time of the winter peak (6 PM) is 80% of the max.

"Cost misrepresentations need correction . . ."

S. S. SANSBURY,
Manager, Sales Development & Training, Union Electric Co, St. Louis, Mo.

Some of the problems that face us as well as the industry to achieve a broad-scale "Year 'Round Comfort Electrically" (program) in all our markets are:

1. How to get enthusiastic support of everyone connected with the utility industry. This is a problem for each individual utility.

2. How to find the means of integrating a program in a local area that profitably brings to bear the full impact and influence of the manufacturer, his distributor, his dealer, and the utility sales organization.

3. How to get everybody on the same electrical team. It doesn't do living electrically or "Year 'Round Comfort Electrically" any good for heat pump supporters to pooh-pooh resistance space heating or for resistance space heating supporters to pooh-pooh heat pumps, or for one heat pump representative to pooh-pooh another.

4. Then there is the problem of establishing and getting recognition of the fact that operating cost comparisons between electric and fuel heating should be based on the annual cost of each, taking into account the difference in the amounts of insulation that are economically sound for the electric vs the fuel method.

There is a very real need of manufacturers and their associates to establish this point with professional societies and trade publications. For example, in the 1956-57 Consumer's Research Annual Bulletin there appear two statements:

". . . If you are now using 1,000 gal of fuel oil at 14¢ a gal—if electricity cost 2½¢ kwhr—the cost of heating with electricity will be $825 as compared with $140 for oil. At 1¢ per kwhr the relative cost would still greatly favor oil at the ratio of $330 to $140."

Again quoting: "The heat pump, still considered in the experimental stage despite over 10 years of use . . . equipment and installation cost are usually high . . . estimates range from $5,000 for a 7-room house in the north down to 10% to 25% above the cost of a standard summer-winter installation in milder climates."

Such misinformation must be corrected.

"Kwhr sales jump 10 times in all-electric home, but cost to serve does not"

W. T. RICHARDS,
Vice President, Indianapolis Power & Light Co, Indianapolis, Ind.

To get management and the company wholeheartedly behind the promotion of the heating market, the solution is simply one of "old-fashioned" selling. You have to know the product you are trying to promote, what it will do for the company and the customer, sell the need for developing the market, offer the solution as to how it should be developed, develop a proper rate structure, and promotional program, and give assurance that all are workable and valuable to the company.

We found that the average all-electric home today represents kwhr sales many times that of the 2,600 kwhr for the average home with gas heating and appliances and electric lighting and small electric appliances. In our area, the average all-electric home will use about 22,850 kwhr for resistance heating, lighting, and appliances and an additional 3,400 kwhr, or a total of 26,250 kwhr, if summer cooling is added. The average all-electric home utilizing a heat pump will use annually about 23,800 kwhr. Acquiring one all-electric home therefore, is comparable in sales volume to ten homes using gas for heating and appliances.

At the time of the study, we determined that the average 1,250-sq ft home would require about 12.5 kw of resistance heating elements. In subsequent experience with electric heating, this connected load is a little high; but based on these figures, the heating load would create a max demand on the distribution system of about 10.6 kw about 8 AM. It would contribute only about 3.9 kw demand on a typical winter evening transmission and generation peak.

A heat pump in this size home, according to our study, would create a max distribution demand of about 8.3 kw and would contribute about 1.33 kw to the evening system peak.

For the total home, it was determined that the max demand on the distribution system would be 14.5 kw for the resistance home and 12.45 kw for the heat pump home. The contribution to a winter system peak would be only 6.0 kw for the resistance home and 6.43 kw for the heat pump home.

Our engineering department calculated that the average all-electric home with resistance heating would require an investment of about $1,734.50 for generation, transmission, and distribution facilities. The comparable home with a heat pump would require a service investment of about $1,779.50.

Here again it was evident that the investment to serve the all-electric customer compared with the contemporary gas home does not go up in the ten-to-one ratio of kwhr sales. The investment in meters, poles, and service drops is comparable for the all-electric and the minimum residential customer. The additional investment in transformers is at a lower rate per kva of increase in size compared with the basic cost for facilities to serve only a minimum residential customer. Also, you benefit in investment from the fact that the increase in peak responsibility of the all-electric customer is not in direct ratio to the increase in kwhr sales.

"Northwest load growth at dead-end . . . space heating only way out"

M. G. KENNEDY,
Manager, Sales, Marketing, and Public Relations, Ebasco Services, Inc,
New York, N. Y.

The Pacific Northwest is generally regarded as the most highly electrified region of the country. Where does electric space heating stand today in this region? The facts show that it has achieved considerable acceptance. A 5% saturation of completely electric heating installations is quite ordinary.

What about promotion? Promotional efforts, even though spotty, have been felt throughout the region, and some utilities have discovered that dealers in their area can build up enthusiastic consumer acceptance for electric space heating without utility help.

I would say that right now utility attitude is in a state of flux. But we have seen signs that some utilities are eyeing electric space heating with renewed interest. One reason for this is the feeling on the part of some utility sales people that a dead-end street on residential load growth has been reached, and that the only way out is space heating. Consider how you'd feel if your average residential use had passed 8,000 kwhr a year.

I think the lesson we can learn from experiences in the Pacific Northwest is that although everyone should view electric space heating with an open mind, that mind should be a "regional mind" or even a "company mind." That is to say, each region and each company has its peculiar circumstances.

"We expect to do a lot of business at 1.75¢"

C. M. WALLACE, JR,
Vice President,
Georgia Power Co,
Atlanta, Ga.

It appears that electric space heating, by heat pump or resistance units, is a good way to accomplish all that we can hope to do—That is raise the yearly average residential kwhr curve for our area—now at 3,436—by a factor of three or four. We see no better way.

Our residential rate for electric heating will average about 1.75¢ per kwhr. Based upon a house insulated properly for electric heating, the estimated cost will be between 12 and 14¢ per sq ft per year. So, an average 1,000 sq ft house should cost between $120 and $140 yearly for heating. We do not use separate meters or demand limiters on electric heating customers. We are competitive in dollars and cents with all fuels except natural gas and coal. We expect to do a lot of business at this residential rate in all parts of our system, regardless of natural gas.

Our commercial customers secure a lower rate for space heating than the regular rate. The incremental cost to the customer is about 1¢ per kwhr.

It may be assumed that once a house is electrically heated it does not cost a cent to operate any unvented appliance during the winter season (with the possible exception of the water heater) since all these appliances contribute Btu's toward the heating of the house, thus requiring less operation of the heating system. In areas where air conditioning is not required and heating is needed in most months, added appliances would not affect the owner's cost but the operating cost would be determined by the degree days.

"Pricing will approach better competitive level"

J. T. COATSWORTH,
Commercial Director,
Edison Electric Institute,
New York, N. Y.

In the years to come electricity will supplant to a great extent all other fuels for residential heating.

Problems of pricing too will be worked out, not at the same level . . . but ever approaching a better promotional and competitive level.

It must never be forgotten that the electric utility is vitally interested in electric space heating. First, because it affords a market for business growth and better service to customers, and, second, because the charactertistics of load growth in many areas of the nation affected by increasing air conditioning are causing a shift from a winter to a summer peak and making it essential to build winter-time load.

It is fundamental that improved load factor increases the utilization of investment and this fact is more important to the utilities than it is to the manufacurers. Utilities have invested some $4 for each $1 of annual gross revenue; whereas manufacturers have invested only about 45¢ for each $1 of gross revenue.

"Our heating customers average $345 per year, use 21,850 kwhr . . ."

J. H. K. SHANNAHAN,
Commercial Manager,
Indiana & Michigan Electric Co,
Ft. Wayne, Ind.

For nearly three years we have been actively promoting electric space heating among our 240,000 customers in northern Indiana and southwestern Michigan. This is an area where we have extremes of temperature, and, in general, it is a 6,000-plus degree day area.

Today, we are selling our residential customers 4,275 kwhr per year. We have 2,446 complete resistance space heating jobs (7½ times 1953), and 172 heat pump installations (8 times 1953). Thirty per cent of the resistance installations, or 720, were sold in ten months of this year. And 47% of all heat pumps, or 81, have been sold in the same period. This indicates 1.09% saturation among residential customers.

It was our intent that home heating become involved in all of our sales activities and all of our sales plans.

We discourage open house promotions unless they include electric heating. We encourage employees to put it in their homes and will help them finance it.

Heating customers average about $345 per year for all-electric service, including heating, which figures 21,850 kwhr at an average of 1.58¢. This compares with our average customer's 4,275 kwhr for an average revenue of $90.40 and an average realization of 2.11¢. In addition, we have an unknown number of partial jobs, added rooms, etc. And this is a tremendous volume and potential. Complaints are at a minimum. Old homes are now beginning to convert. They are following the example of the new homes.

Our heating customers are contributing 150 kwhr to our average consumption. Our appliance saturation in electrically heated homes is nearly double the company average. The cost of operation is beginning to lose its importance in the mind of the customer because the word has gotten around that it isn't too high.

"Neither weather nor gas is a threat . . ."

JACK BRUCH,
General Supervisor,
Eastern District Sales,
Cleveland Electric Illuminating Co,
Ashtabula, O.

It was from a small group of pioneers in all-electric living that we made our basic decision to promote electric heat. From a marketing viewpoint we were convinced that electric heat, although considerably more complex, would provide our customers with as many, if not more, benefits than the other major appliances we had promoted aggressively through the years. With the cautious approval of our engineering department we began to develop plans for the promotion of electric house heating. At this point one rule was established. Aggressive promotion would not be undertaken until we could keep customers' complaints under 1%.

After two years of promotion we still do not consider the weather or the gas company any serious threat to the objectives we have established. This may sound like a foolhardy statement, but let's look at the record. To date we have approximately 900 homes in our service area heated electrically. True, out of 450,000 customers that is only a .2%, but remember over half went on the line on their own accord.

Our program for 1957 is designed to sell 560 residential heating installations. It may be interesting to note that our forecast in the ratio of heat pumps sold will increase from 15% in 1956 to 38% in 1957.

I honestly believe that once we achieve a saturation of 5%, electric heating will grow at a faster rate than any single appliance we have ever known.

"Visit builder, buyer for bigger sales . . ."

E. A. WILSON,
General Sales Manager,
Alabama Power Co,
Birmingham, Ala.

"When will you have electricity where we can use it for heating our homes?" We long have sought for a practical method to satisfy this interest by the customers in Alabama Power Co's service territory.

In rural areas our service engineers have been most helpful in promoting the all-electric home. In one division, meter-set orders for temporary service for construction service are brought to their attention. An engineer immediately visits the contractor, determines the scope of plan of the residence. Then he visits the customer for whom the house is to be constructed and presents the all-electric home story. He offers assistance in planning the heating system. In this division 62 contracts for all-electric homes resulted in the first nine months.

Maintaining close contact with architects, builders, dealers and other buying influence groups is an important phase of our residential heating program. During the first ten months of 1956, residential sales engineers

made a total of approximately 7,150 contacts with this group. Nearly 1,300 estimates were furnished.

Up to Dec. 31, 1955, there had been connected to our system a total of 1,738 electrically heated homes of which 1,410 are equipped with some form of resistance heating and the remaining 328 have heat pumps. During the first ten months of this year (1956) 598 customers have contracted for electric heating—394 resistance heating, 204 heat pumps. For the year, our estimate is 700 of which 460 will be resistance heating and 240 heat pumps. Cost of the program: $72,000 including salaries, travel, and demonstration expenses.

Sales for 1957 are projected for 1,000 additional all-electric homes—650 resistance, 350 heat pumps.

"Needed: Simplified way to distribute heating, cooling through house"

E. R. AMBROSE,
Head, Air Conditioning Division,
American Gas & Electric
Service Corp, New York, N. Y.

The customer is not so concerned with the first cost of the heat pump unit as he is with the total cost of the installation. On practically all of the residential installations to date, the heating and cooling distribution system represents 25-50% of the total cost.

This high cost results partly from the fact that few major improvements or advancements have been made in the application of residential air conditioning during the past 25 years. The industry is, therefore, faced with the difficult problem of adapting present day inadequate heating designs to the modern year-round air conditioned home.

There is the possibility of pre-fabricated ductwork for fast, low cost installation. Also a simple duct system in combination with decentralized resistance heating can be used. The joint AEIC-EEI Heat Pump Committee has the subject of "Distribution of the Heating and Cooling to the Conditioned Space" high on its list of activities for the coming year.

"Volume selling begins for heat pumps in '57"

M. S. ANGIER,
Manager, Utility Relations,
Heat Pump Department,
Westinghouse Electric Corp,
Staunton, Va.

1957 will mark the real beginning of volume heat pump sales. It will also mark the entrance of several other nationally known manufacturers in the heat pump field, the promotion and sale of remote type heat pumps by several manufacturers, and the introduction of new heat pump models. All of this should definitely stimulate the sale of heat pumps.

I believe you will agree with me in saying that our success in 1957, as well as in the years ahead, lies with the heat pump dealer. If we can determine accurately what it takes to make him successful, then we should have the key to what we, as manufacturers and the utility serving his area, must do to satisfy fully our own particular objectives.

We shall continue to support energetically and improve our heat pump distribution in other areas, but no extension of that distribution into new areas is contemplated during 1957.

"Sell 1,000 tons of heat pumps in one campaign"

KARL K. HICKMAN,
Asst Supervisor,
Air Conditioning Dept,
Florida Power Corp,
St. Petersburg, Fla.

Last June our Residential Department conducted a campaign to sell 2,500 tons of residential summer cooling in June and July. This was known as "Operation 2,500." Dealers were encouraged by offering $1 per ton sold within the campaign time limits. Our own sales representatives were tempted with a trip to a large appliance manufacturing plant. Result: 4,899½ tons, of which 1,043¾ tons were heat pumps and 642 tons of that were central units.

We sell the ultimate buyer . . . to a great extent through the planning and advisory services we offer. We receive many requests from homeowners for suggestions and recommendations as to what kind of heating or cooling plant to install. This is the ideal type of prospect. He already knows and admits he wants to buy. We don't sell them all; but before he leaves our office, he knows what a heat pump is and what it will do for him.

"Heat pump support is negative without strong utility endorsement . . ."

H. M. BRUNDAGE,
General Manager,
Weathertron Dept,
General Electric Co,
Bloomfield, N. J.

Buying influences are the people who directly or indirectly influence the buying public.

Anything less than a strong, aggressive endorsement of central plant heat pumps by the local utility constitutes a perfectly natural excuse for these buying influences to give passive or negative support.

Another problem we manufacturers face is combination utilities. As you know, approximately one half of all residential customers are served by combination companies. This means that for the most part, one half of the potential market for all-electric year-round air conditioning can and probably will for many years receive no active utility support. And further, the buying influences just referred to will be channeled negatively rather than positively in these local markets. Almost without exception, combination companies either lean directly to promote the gas business at the expense of the electric approach or are neutral, which is the same thing as being against it in the first place. We know of only three major combination utilities in the country who today are supporting actively and promoting central plant heat pumps.

"What we found out about 26 heat pump homes . . ."

JOHN B. TAYLOR,
Vice President,
Atlantic City Electric Co,
Atlantic City, N. J.

During the period when our first few heat pumps were being installed, we were anxious to obtain as much information as possible on problems involved in serving these units. Recording demand meters were located on services of 26 homes with air-to-air units.

Those 26 homes tested have an average of 1,765 sq ft and vary in size from 1,000 to 4,500 sq ft. Average connected load per home, including all appliances, is 39 kw with an average measured demand of 17.2 kw. Average annual use of energy for the test group amounted to 34,100 kwhr for the 1955-56 heating and cooling season. Average coincident demand for the group was on December 21, 1955 at 10 AM and amounted to 13.8 kw per residence. The coincident demand at the time of system peak for our system, 6 to 7 PM on that date, amounted to 11.6 kw. You will note that this amounts to 67.5% of the average non-coincident demand and 84% of the average max coincident demand which occurred at 10 AM on the same date. Annual load factor of the heating and cooling load expressed in terms of the coincident demand at time of system peak is about 32%.

Most serious distribution problem resulted from customer complaints of light flicker and operating diffculties with other appliances sensitive to voltage fluctuations. We found a 3% drop is the max acceptable at the customer's service entrance if the drop resulted from the starting of his own heat pump. But from someone else's it must not exceed 2%.

It was apparent also that merely increasing the size of secondary wiring would not solve the problem as the voltage drop in the distribution transformer itself produced a substantial amount of the total drop. Experience indicated that the transformer serving the heat pump must be located on the same pole to which the service drop is attached. The problem of voltage drop within the transformer itself was solved by employing a series capacitor in the primary neutral lead to compensate for the voltage fluctuation due to transformer impedance.

"Sell economy to reach architect and builder"

E. C. BIRKNER,
Associate Editor,
House & Home Magazine,
New York, N. Y.

What's holding back the architect and builder today on electric heat? The answer is simple. Ignorance and lack of knowledge.

If you sell electric heat, you are selling what appears to be a highly marketable service; comfort tied to convenience and cleanliness. But to sell this triple-faceted service to the homebuyer you must be able to sell it to the builder, contractor, and architect through economy. This economy must stem from the installation of an electric heat system and the use-cost of this system once it has been installed.

The builder and architect want to know something about the "how to" of electrical heating. They want to see workable heating plans. They want to see some successful applications of these heating systems. They want to know consumer reaction to them—where they fall down, where they have marked advantage.

You can tell a builder that electrical resistance heat-

ing will eliminate the need for a chimney and that he will gain additional space inside the house by its absence and the cost of laying brick and mortar. You can tell a builder how he can get his house heated during construction (important for winter building) provided you can turn the current on right away. You can and should point out to a builder that he will have some of these evident economies somewhat counterbalanced by application of greater insulation.

But the builder—and the same goes for the architect and contractor—wants to know how he can get all these seeming benefits. He wants to know if there is an electrical contractor in his neighborhood that could put such a system in his house and guarantee its function and economy. He wants to know just how this system fits into the rest of his operation. Does it interfere with framing, dry walling, painting, plumbing, etc.

Unless you can supply him with this information, unless you or your affiliated manufacturers, or the electrical craftman can supply this information—wiring diagrams, liaison between subcontractor and builder—the rosy dream is shot.

"Power salesman is key to commercial heat pump sales"

PAUL F. O'NEILL,
Manager, Utility Contacts,
Weathertron Dept,
General Electric Co,
Bloomfield, N. J.

Your power salesman or industrial and commercial department personnel are the key to heat pump sales in the commercial and industrial market. There are six reasons why:

1. He is generally the first to know about a new commercial or industrial project.

2. He is known and respected by the architects and consulting engineers. When the power salesman presents an operating cost comparison or discusses the advantages of electrical equipment vs other equipment, the architects and consulting engineers listen with respect; and they place confidence in his comments.

3. He knows that electric loads have diversity. They appreciate the importance of diversity in calculating billing demands.

4. He knows that electric usage varies from month to month. He knows that all of the electric loads contribute to the heating requirements of the building. In many installations the lighting loads and other electric loads will heat a building when the outdoor temperatures are as low as 35F.

5. He knows about the existence of ratchet clauses; for example, such as the billing demand shall not be less than 70% of the max during the previous 11 months. Ratchet clauses are important in developing operating cost comparisons.

6. He can talk about the total electric bill and not just one segment like heating and cooling. The sales story generally is in the comparison between the total annual operating cost of the all-electric establishment and that of a combination gas and electric operation.

". . . Make up your minds whether you really want the heating market"

PAUL M. AUGENSTEIN,
General Manager,
Room Air Conditioner Department,
General Electric Co,
Louisville, Ky.

The time is close at hand, as a matter of fact within the next couple of years, when you and your management groups are going to find it necessary to make up your minds whether you really want the heating market.

When I joined the General Electric Co in 1935, I learned immediately that you were interested intensely in promoting the use and sale of the electric water heater. As a matter of fact, you still are. But I think you have been just a little bit guilty of spending your millions along with ours in trying to fit the electric water heater market to the product.

I have a gas furnace which is a fairly acceptable means of heating under today's development of the art. Not once has anyone from the gas company demanded that I turn it off, turn it on, turn it high, turn it low, that I insulate the walls of my home or that I equip the house with storm windows. I somehow or other just simply know that if I want more efficient heating, I can achieve it by doing these things; but the choice is left to me.

What I am asking is that you avoid if possible any restrictive measures which may appear to be from your business standpoint desirable but may either restrict the consumer's appetite or prevent the manufacturer and you from capitalizing on the market.

Reprints of this report as well as complete copies of conference papers are available from Electrical World, 330 W. 42nd St., N. Y. 36, N. Y.

FROM GENERAL ELECTRIC . . .

NEW, Quiet-operating Boiler Feed Pump Motor

With reduced noise level, improved ventilation, Polyex® insulation

ELECTRIC DRIVES FOR THE ELECTRIC INDUSTRY

WHERE ELECTRICITY IS GENERATED, ELECTRIC DRIVES GIVE TOP PERFORMANCE . . . HERE'S WHY

Progress Is Our Most Important Product

GENERAL ELECTRIC

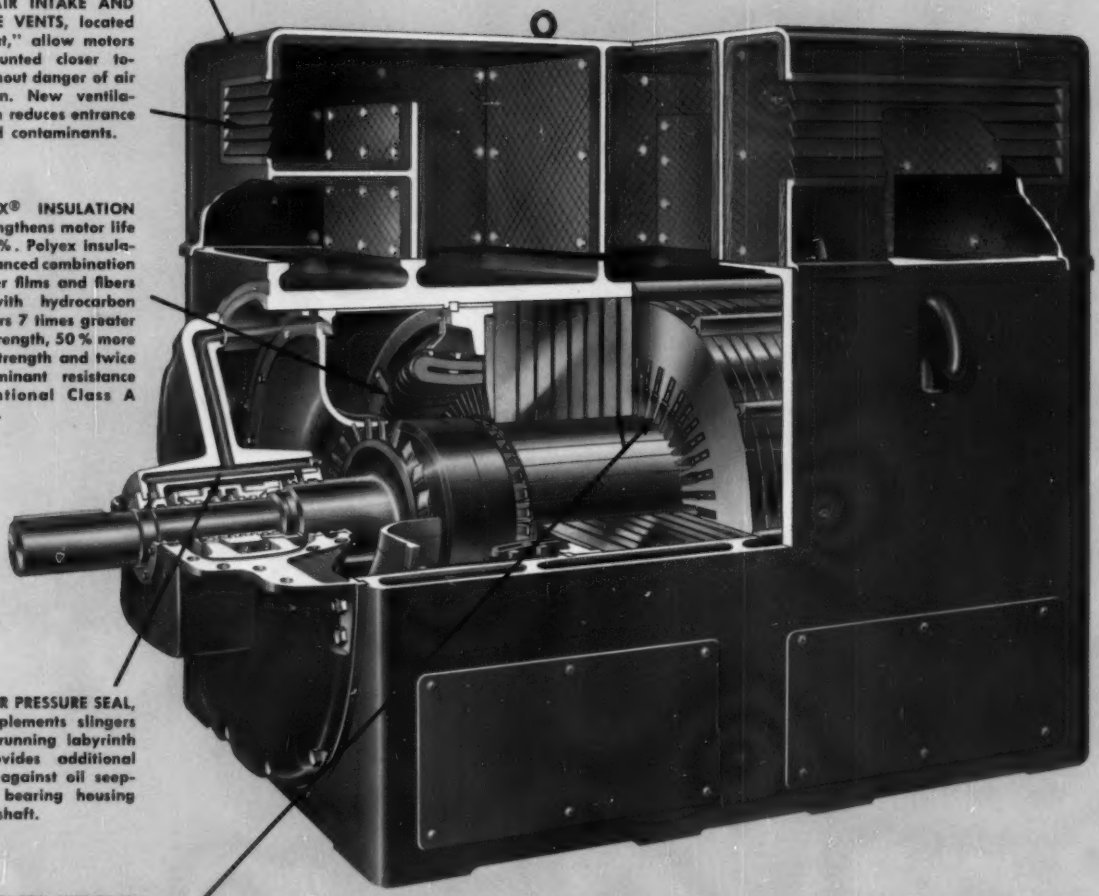
ELECTRIC DRIVES FOR THE ELECTRIC INDUSTRY

NEW General Electric Boiler Feed Pump Motor is designed for quiet operation, long life

1. NEW REMOVABLE "TOP HAT" is designed with a series of chambers and baffles to reduce motor noise level. When "top hat" is lined with sound-absorbing materials, motor noise is thoroughly dissipated and a sonant sound quality results.

2. NEW AIR INTAKE AND DISCHARGE VENTS, located in "top hat," allow motors to be mounted closer together without danger of air recirculation. New ventilation system reduces entrance of dirt and contaminants.

3. POLYEX® INSULATION SYSTEM lengthens motor life up to 100%. Polyex insulation, a balanced combination of polyester films and fibers bonded with hydrocarbon resins, offers 7 times greater physical strength, 50% more dielectric strength and twice the contaminant resistance of conventional Class A insulations.



4. NEW AIR PRESSURE SEAL, which supplements slingers and close-running labyrinth seals, provides additional protection against oil seepage from bearing housing along the shaft.

5. NEW STATOR WEDGING techniques provide tight fitting coils in stator. Non-hygroscopic trapezoidal wedges are individually jacked into slots and cemented to fillers. This tight, stable fit has virtually eliminated coil looseness and resultant wear.

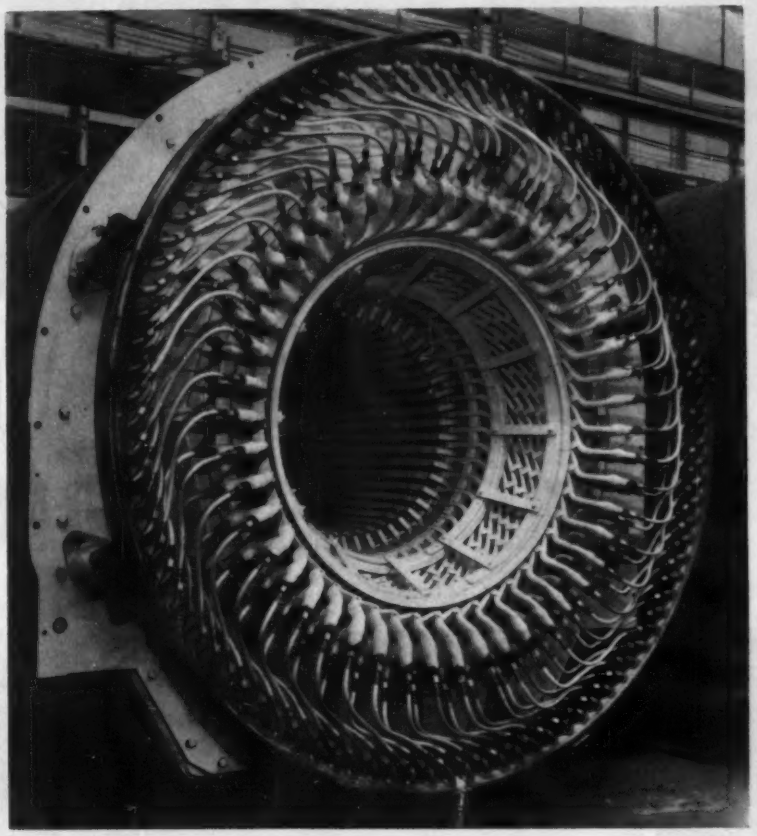
For more information on General Electric's New Boiler Feed Pump Motor contact your nearest G-E Apparatus Sales Office or write to Section 871-1, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

TODAY'S DESIGN TRENDS

Water Cools 30-Mw Unit's Stator Winding



A 30-Mw generator whose stator winding is cooled by water circulating through the coils, is now ready for installation at the Bold (St. Helens) power station of Great Britain's Central Electricity Authority. This 11,800-v, 3,000-rpm generator is a prototype.

The water actually flows through the windings in contact with live copper. It enters from a header pipe at one end of the stator through tubes of plastic insulating material joined to each conductor. It flows from one end of the machine to the other through the parallel conductor strands. At the discharge end plastic tubes convey the water to an outlet header.

Although designed to use distilled water, the machine, it is believed, is capable of operating with ordinary tap water.

Differs in Cooling Only

The machine, designed and manufactured by Metropolitan-Vickers Electric Co, will be substituted for one of four standard 30-Mw units ordered for Bold. Two of the latter are now installed. Apart from its water-cooled winding, the third generator is a duplicate of the others, its winding having been designed to fit into the same size stator core and slots.

Standard works tests were made to determine open and short-circuit characteristics and losses. In these tests distilled water was used that had a conductivity of 2.5 reciprocal megohms per cc. They were followed by a 6-hr temperature run at approximately full generator rating of 37.5 Mva, 0 pf, and 11.8 kv.

At this load, total loss in the water in the plastic tube connections was computed to be less than

(*Continued on page* 92)

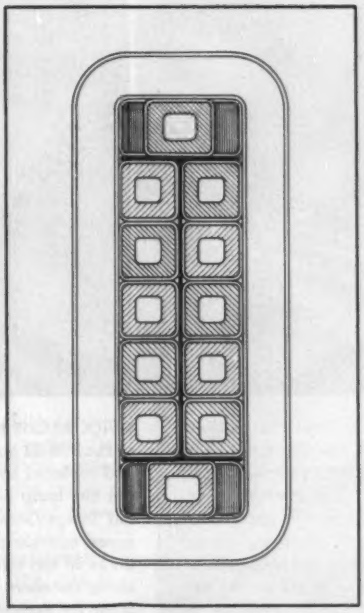


FIG 1—WATER-COOLED UNIT is cooled by water circulating inside insulation

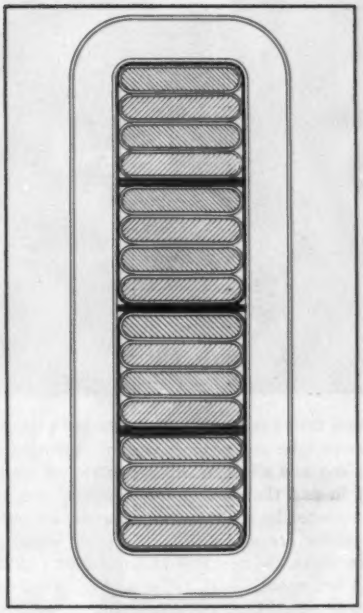
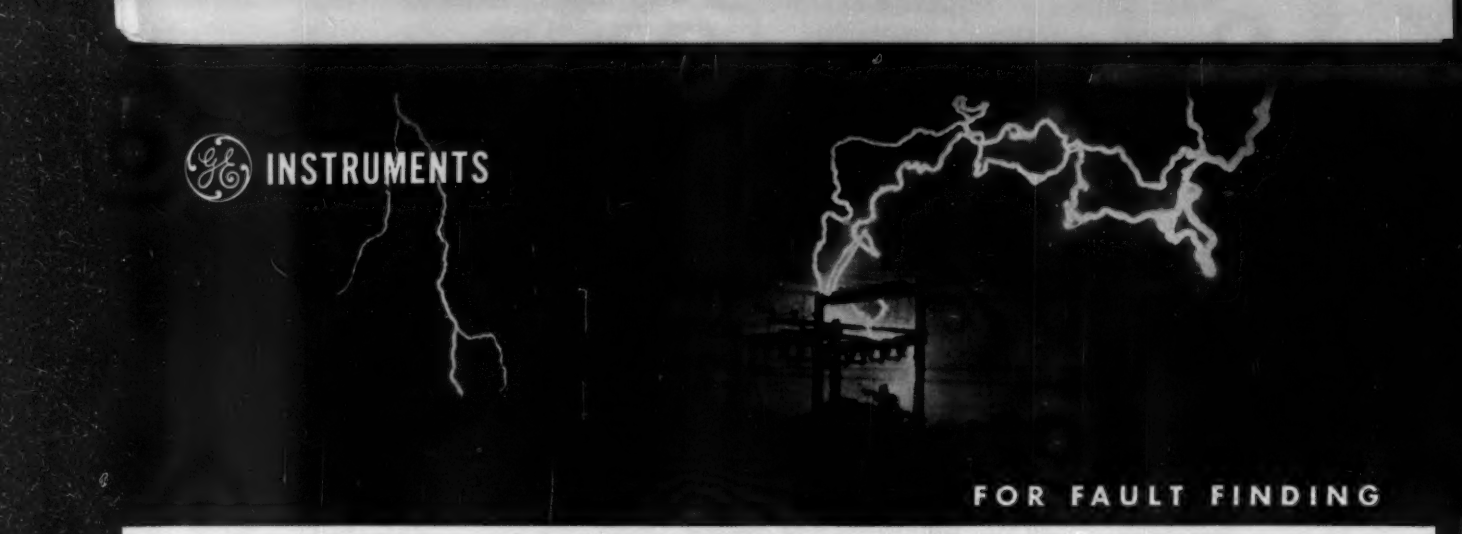
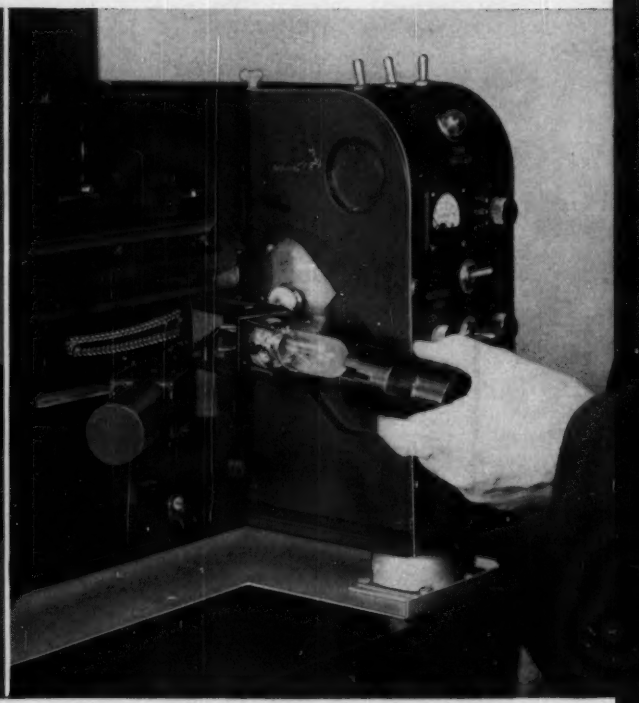


FIG 2—CONVENTIONAL UNIT has its cooling medium outside insulation

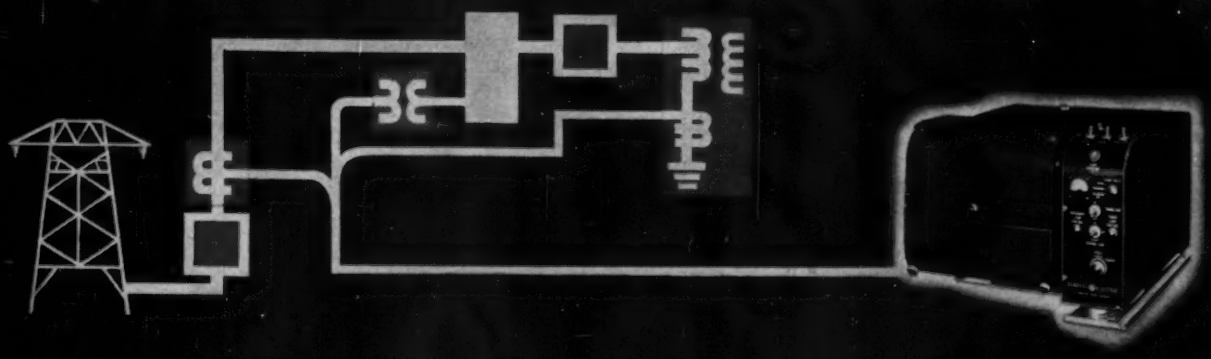


SAVE TRAINED MANPOWER AND WITH GENERAL ELECTRIC'S NEW



NEW TYPE PM-21 OSCILLOGRAPH has exclusive roll-out chassis that saves time and reduces cost of operation and maintenance. Roll it out and all parts are accessible for convenient operation. Roll it in and the oscillograph is out of the way. The instrument is protected by a metal door on which a trouble light and operations counter are mounted. For greater versatility in recording many variables, the new PM-21 holds from 1 to 22 bifilar galvanometers. It has space for 11 bifilar and 60 pencil-type or 18 bifilar and up to 14 pencil-type galvanometers.

QUICK ACCESS TO ALL VITAL PARTS is assured by the unique design of the PM-21 automatic oscillograph. Lamps can be easily removed and replaced by simply lifting off the record holder and swinging out the lamp holders. Semi-skilled personnel can replace burned-out lamps because no optical adjustments are necessary. Quick access to other parts of the oscillograph is provided through hinged doors in the case. The entire cover can be removed by loosening three fasteners. All controls for the instrument are grouped in front for greater convenience of operation.



FOR SYSTEM CHECKING

IMPROVE SYSTEM MAINTENANCE PM-21 AUTOMATIC OSCILLOGRAPH

Rapid analysis of system performance saves valuable manhours in locating faults and reduces shutdowns caused by faulty circuit breakers, relays, current and potential transformers.

If engineering manpower is a critical item at your plant, then General Electric automatic oscillographs offer an opportunity to stretch your limited manpower. With automatic oscillographs, engineers quickly get the information needed for analyses of system performance and operation. Lost time is minimized in locating faults, evaluating transient disturbances and checking circuit breaker and protective-relay performance. Corrective measures can be defined from oscillograph records, allowing you to take remedial action immediately. For best results, oscillographs should be located at major substations throughout the system. *Contact your sales representative for further information, or write Section 585-33, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

SEPARATE PAPER HOLDERS are used in the PM-21 oscillograph to allow removal of the exposed paper at any time for development. After removal of exposed paper, an extra holder can be attached for continuous recording while the exposed paper is being developed. Up to 200 feet of unexposed paper may be placed in the upper holder, allowing up to 150 oscillograms without reloading. By replacing the automatic record-paper holder with a general-purpose holder, the PM-21 becomes a portable, general-purpose oscillograph.

ALSO AVAILABLE from General Electric are a 7-channel automatic oscillograph (below left) and a portable general-purpose oscillograph for testing circuit breakers, relays, etc. (below right).

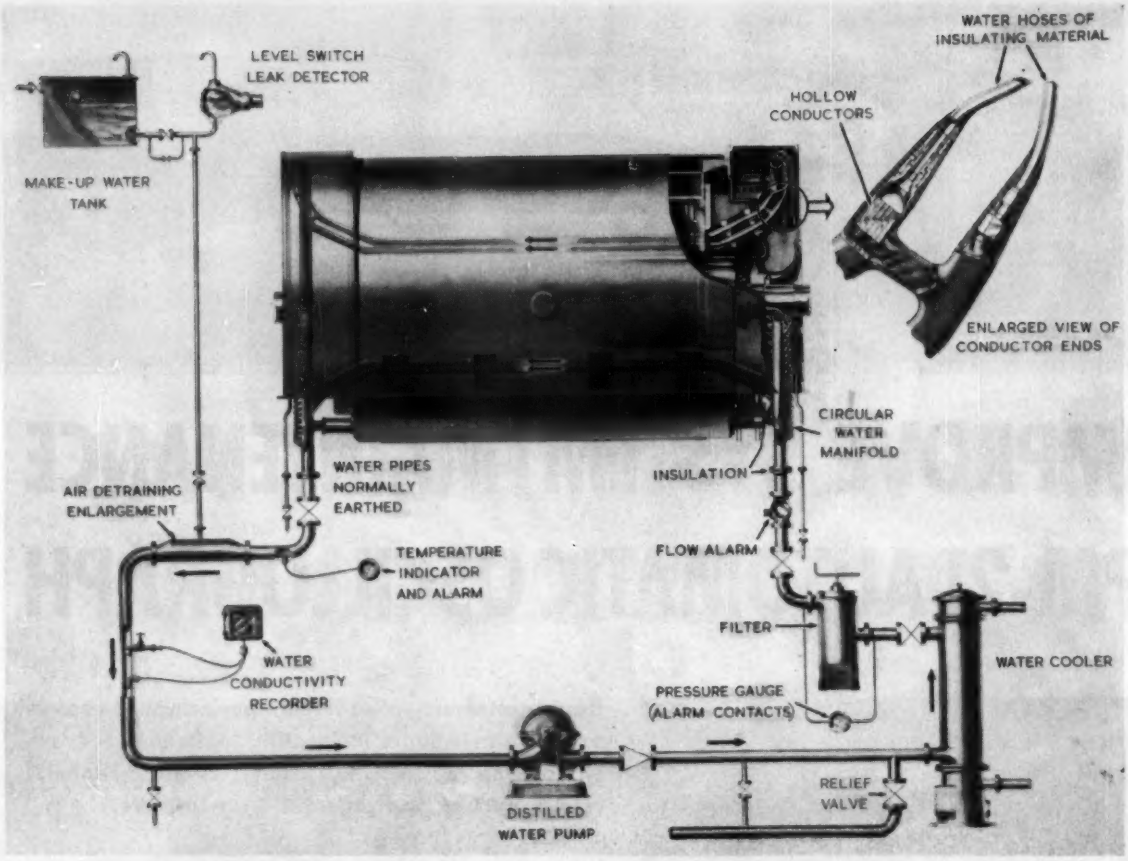


DIAGRAM shows the water circuit with duplicate pumps and coolers, strainer, flow alarm, water temperature indicator, temperature alarm and conductivity meter. Water circuit is supplied from the header tank immediately above machine

Water-Cooled Generator

(*Continued from page* 89)

1 kw, and it is believed that the loss would not have exceeded 10 kw were tap water used. Maximum temperature rise of the distilled water was 2C. The copper temperature rise exceeded this by only 0.2C. Power for pumping the water was 8.8 kw, the pressure drop across the windings being 18 psi.

These tests were followed by a 3-phase short circuit at full voltage and a final high-potential test at 24.6 kv for 1 min between phases and to the ground with the water flowing through the conductors.

Conventional conductor fitted into the stators of other generators in the same station have a temperature rise of about 65C outside the insulation for a loading of 1,835 amp with cooling air at 35C. Estimated copper temperature is about 115C. The water-cooled conductor, however, carried 1,750 amp for 5 hr, after which the copper temperature was only 29.2C. The inlet distilled water was 27C.

GENERATION—Maintenance

Rubber Coating Stops Penstock Rivet Leaks

Leaking rivets in the 9,000-ft, 9.5-ft dia steel penstock serving the San Fernando hydro plant of Los Angeles Department of Water & Power were made bone-dry through the application of a synthetic rubber coating. This coating was considerably cheaper than electric welding of practically all rivets in the penstock.

Welding Too Costly

To stop leaks, the costly welding of all rivets electrically was considered. As the size of the plant did not justify such expenditure, an internal coating over the riveted areas was tried. The entire length of the penstock was sandblasted before application of the paint. C.T.P. paint was applied to within about 4 in. of all rivets. A special primer was applied over unpainted areas.

Then several layers of a special Neoprene compound were applied over and around the rivets and the riveted areas. Layers of Neoprene compound were sprayed to about the same thickness of the C.T.P. coating. It is necessary to sandblast down to clean metal, and to apply the primer coat and Neoprene compound layers carefully.

(More How To on page 94)

Now! At Load Bonus Settings, General Electric's new ML-32 Voltage Regulator . . .

IGNORES SHORT CIRCUITS

By D. D. MacCarthy, Manager—
Feeder Voltage Regulator Engineering,
General Electric Company.

With the advent of Load Bonus, which G.E. introduced last year, some utilities asked what effect short circuits would have on regulators operating on higher current settings. Now we can give this quick and categorical answer:

General Electric ML-32 step regulators will withstand short-circuit currents up to 25 times the increased current at each Load Bonus setting for the time durations tabulated below.

Load Bonus, of course, means that, at ±5% regulation, G-E ML-32 single-phase step voltage regulators are suitable for currents up to 160% of rating, to a maximum of 400 amperes.

Now, the ML-32's extra short-circuit strength allows you to take full economic advantage of the 60% Load Bonus feature in applications where previously short-circuit capacity has been a limitation. Check the chart below. You will note that, in all cases, the ML-32 regulator will withstand short circuits long enough for circuit-interrupting devices to go into action.

For more information on the ML-32, write Section 423-16, General Electric Co., Schenectady 5, N. Y. or contact your General Electric sales office or agent.

Add load, maintain short-circuit capacity:

Regulating Range (Percent)	Load Bonus Current* (% of basic rated current)	Short-circuit Capacity** (% of basic rated current)	Short-circuit Duration (Seconds)
±10	100%	100% x 25	2.0
± 8¾	110%	110% x 25	1.6
± 7½	120%	120% x 25	1.4
± 6¼	135%	135% x 25	1.1
± 5	160%	160% x 25	0.8

*400 amperes maximum
**10,000 amperes maximum

ML-32 step regulators will withstand short-circuit currents up to 25 times the increased current at each Load Bonus setting for the time durations tabulated at left.

Progress Is Our Most Important Product

GENERAL ELECTRIC

TALKIE enables line foreman to communicate directly and continuously with men working on a pole. Its use obviates old hand signals and has safety benefits

'Talkie' Used in Stringing Conductor

A portable radio "talkie," weighing only a few ounces, is furnished to line foremen of the Lorain Medina Rural Electric Co-op. The truck driver now gets his instructions directly from one man through a mobile two-way radio on the same frequency as his foreman's "talkie." The new equipment is especially effective when, during the stringing of conductors, the truck and foreman are a half mile or farther apart.

Inspection Reduces Pole-Rot Hazards

In 1956, two workmen died and six were injured seriously as the results of poles in line collapsing while the men were climbing, according to the Rural Electrification Administration. These accidents, says the REA, would not have occurred had the poles been properly checked to determine their condition. The agency has prepared a memorandum on the precautionary inspection of poles in line.

The critical section of a pole, according to the memorandum, is that between the ground level and 1 to 2 ft above ground. Pole deterioration can be occasioned by lightning damage, pole displacement following a collision or a storm, or the nature of the ground.

Examination can reveal that guying or propping with pike poles is a prerequisite to safe climbing. Decay and insects also attack poles not properly treated, or continuing in use long after treatment.

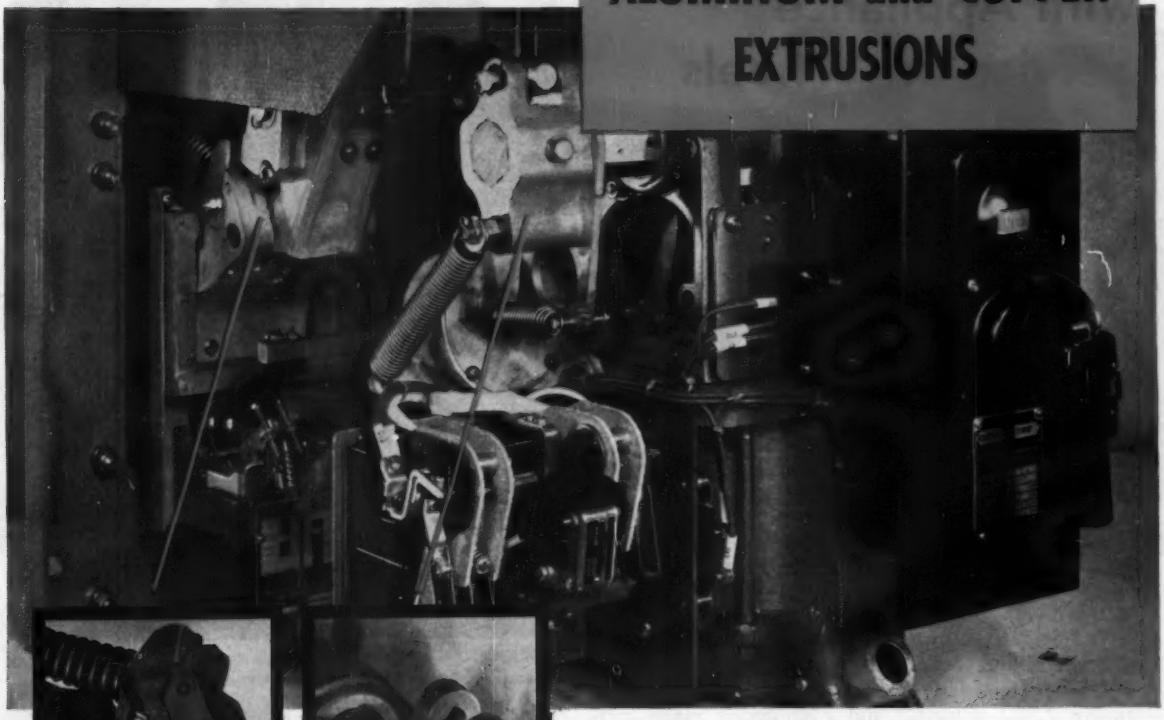
A would-be climber should sound the pole with a hammer, beginning at about waist height and working around and downward to the ground line. As he taps, he should listen attentively. A pole free from internal decay and insect damage rings solid. A decaying pole, or one riddled by insects, has a hollow, "punky" sound.

When the sound changes noticeably as the tapping approaches the ground, examination below the ground level is indicated. The ground should be opened on one side of the pole sufficiently to allow the pole to be struck with the hammer below the ground line. The excavation should be begun carefully a foot or farther from the pole so that the last shovelful of earth can be taken out practically intact, retained on the shovel and replaced as nearly as it was originally. This care avoids unnecessarily mixing of the soil containing exuded preservative.

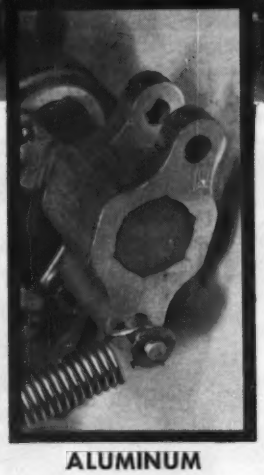
When surface softening is to a depth of 1 in. and no other damage is discovered, the pole is strong enough to permit climbing.

REVERE
ALUMINUM and COPPER EXTRUSIONS

I-T-E CIRCUIT BREAKER—KD (3,000 amp. rating) showing progressive assembly with Revere Copper and Aluminum Extrusions in place. I-T-E Circuit Breaker—KE is same type with 4,000 amp. rating.



COPPER
for conductivity



ALUMINUM
for economy

—form a Money-Saving team in latest

I-T-E CIRCUIT BREAKERS

Revere T. A. Service an Important Factor in Ultimate Design of Parts

The larger of the two extruded and drawn copper shapes shown at extreme left started out on the drawing board as two pieces. It was thought that a single shape of this size could not be made satisfactorily. At this point, I-T-E Engineers got together with Revere's T. A. (Technical Advisory) Service and threshed things over. The final result is the one-piece extrusion shown and a reduction in machining time.

Aluminum was selected for the other extrusion shown because I-T-E found that it cost less per pound of metal and had a higher strength ratio when compared to a casting. Also, space was a factor. In all, Revere supplies 5 copper and 2 aluminum extrusions for KD and KE type I-T-E Circuit Breakers. All were designed to fit specific requirements of I-T-E Engineers. Where it could be used satisfactorily, aluminum was applied because of economy, while current carrying members called for copper.

This is still another example of Revere supplying the metal that will do the best job and with the greatest economy . . . be it aluminum, copper or any one of their alloys. So, with new things happening all the time in non-ferrous metals it can pay you to keep in close touch with Revere.

COPPER ★ BRASS ★ 18 01 REVERE ★ ALUMINUM

REVERE COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

IP&L Speeds Repairs with Appliance Service on Wheels

FREEMAN G. SMITH, Supervisor of Appliances and Electric Repairs, Indianapolis Power & Light Co, Indianapolis, Ind.

Appliance repairs are speeded up, costs cut, and customers get better service on the Indianapolis Power & Light Co's system since the company put a fleet of special repair trucks into service. The new truck has a van-type body that is equipped with a work bench, carries parts and tools, and provides facilities for doing many jobs on the spot. The company uses it to service domestic ranges, water heaters and commercial cooking equipment.

Facilities on the truck have made it possible for the repairman to complete more than 95% of the water heater repairs on the first call, including jobs as large as removing the entire heater and replacing it with the customer's new unit. This type of job usually requires minor changes in plumbing and wiring which also can be taken care of from the truck.

The percentage of domestic electric range and commercial cooking repairs completed on the initial call is not so high as that for water heaters. Of the approximately 2,500 domestic and commercial range calls made in a recent three-month period, we were able to finish the job in more than 50% of the cases. These jobs usually require replacement of elements and parts, the most common of which are carried on the truck. With one exception among all our domestic and commercial range service requests, we were able to give partial or temporary service to the remaining jobs.

Water Pump, Too

Parts are stored in specially built drawers and bins. The work bench, complete with vice, enables the repairman to complete many jobs that ordinarily would have to be taken into the company shop. Special tools and equipment are also carried, including meters, testing equipment, wrenchs, and others.

One unique feature of the truck is the portable centrifugal water pump which is standard equipment on the truck fleet. It is used to empty water tanks when replacing heater elements, or replacing a defective heater with a new one. We have found it especially useful where the heater is located in a kitchen, utility room, or any place where there is a possibility of water damage to floors or floor covering. Basements without drains are another example of where we have used it a great deal.

These newly designed and equipped trucks are exceeding all the benefits and economies the company had anticipated.

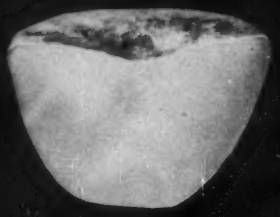
(*More Selling on page* 98)

WORK BENCH in truck allows repairman J. R. Ayers to work on range element that might otherwise have gone to company shop, slowing service and inconveniencing customer

BINS for parts and tools are seen through rear door of truck. Designed to hold tool and parts of varying sizes and shapes, they were also planned to meet the needs of repair work

wonder where the BUBBLES went?

Visible voids spot the test pour of an improperly-fluxed heat of aluminum.



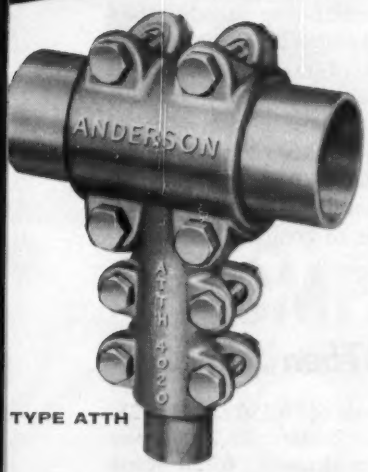
A typical cross-section of sound, bubble-free Anderson Aluminum test pour.

QUALITY CONTROL from the very start removes any chance of "gas porosity" weakness from

ANDERSON

Aluminum

SUBSTATION CONNECTORS



TYPE ATTH

ANDERSON PREDETERMINES LONGER LIFE ... greater efficiency ... and higher tensile strength by putting to work the *probing, fact-producing* experiences of 30 years of Aluminum Connector manufacture.

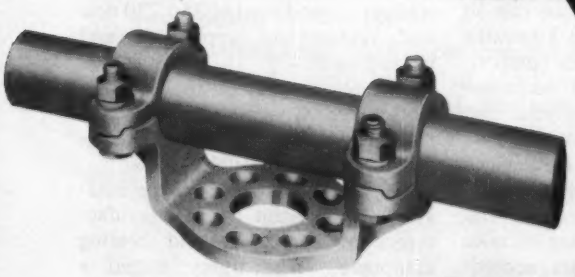
Insuring "high density" by completely eliminating *pin-hole gas porosity* in aluminum castings is just one of Anderson's check-point measures in the production of connectors of outstanding quality. Every heat of aluminum is checked to guarantee that no connector will fail in service because of *voids* in the casting created by *tiny gas bubbles!*

Any Anderson Representative can give you the full, detailed story of our exacting QUALITY CONTROL measures ... consult your nearest Representative or write to the home office.

Aluminum & Bronze POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES
for SUBSTATION • TRANSMISSION • DISTRIBUTION

ANDERSON ELECTRIC

CORPORATION
BIRMINGHAM 1, ALABAMA



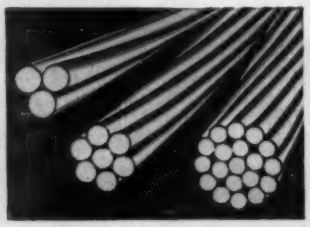
TYPE AUR

TYPE ACF

TYPE ATTC

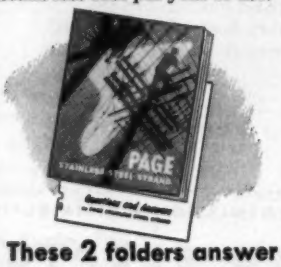
PAGE

Stainless Steel Strand



Its low cost per year means true economy

• Whether you are installing new lines or replacing old ones, bear in mind that the cost of even the finest material is only a small fraction of the total cost. You will find real economy in using PAGE Stainless Steel Strand—the finest made. It is higher in strength-to-weight ratio, tensile strength, elastic limit, and resistance to corrosion and abrasion. It lasts longer, needs replacing less often—this means less cost per year of use.



These 2 folders answer many questions about Stainless Steel Strand

• How does PAGE Stainless compare in conductivity with copper; with steel? How about comparative corrosion resistance; fatigue resistance? How about adaptability to diverse uses? These and many other questions are answered in two informative folders. Ask for Folders DH521 and DH288. Write us at Monessen, Pa.

Another fine PAGE product

• PAGE Stainless Steel Lashing Wire is ideal for lashing conductor cables to a strand messenger by machine. Available in 3 grades—each in 2 sizes.

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

Laundry Show Proves Big Promotion

Chicago Electric Living Institute's recent month-long laundry show was such a success that it was continued a second month by public demand. The event, a mass practical demonstration of 14 brands of automatic electric washers and dryers, was one to which Chicago women were invited to bring soiled clothes to have them washed in the machines that most interested them. The atmosphere was relaxed, and the women were under no obligation to a store salesman; they evaluated the machines and many were *pre-sold*. After that, the appliance dealer is said to have had an easy time . . . merely writing the order to complete the sale.

Competitor's Corner—*and Then Some!*

Electricity may be a "natural" for heating, refrigerators, ranges, air conditioning, etc., but anyone in the industry who thinks we can sit back and depend on the kilowatt's innate superiority over its competition had better take a second—and a third—long look at what that competition has in mind.

Milwaukee Gas Light Co is planning to use sight, sound, music, models and drama in an all-out program aimed at doubling its sales during the next four years, according to a recent report in *Gas Age*.

The bullseyes on this sales target include:

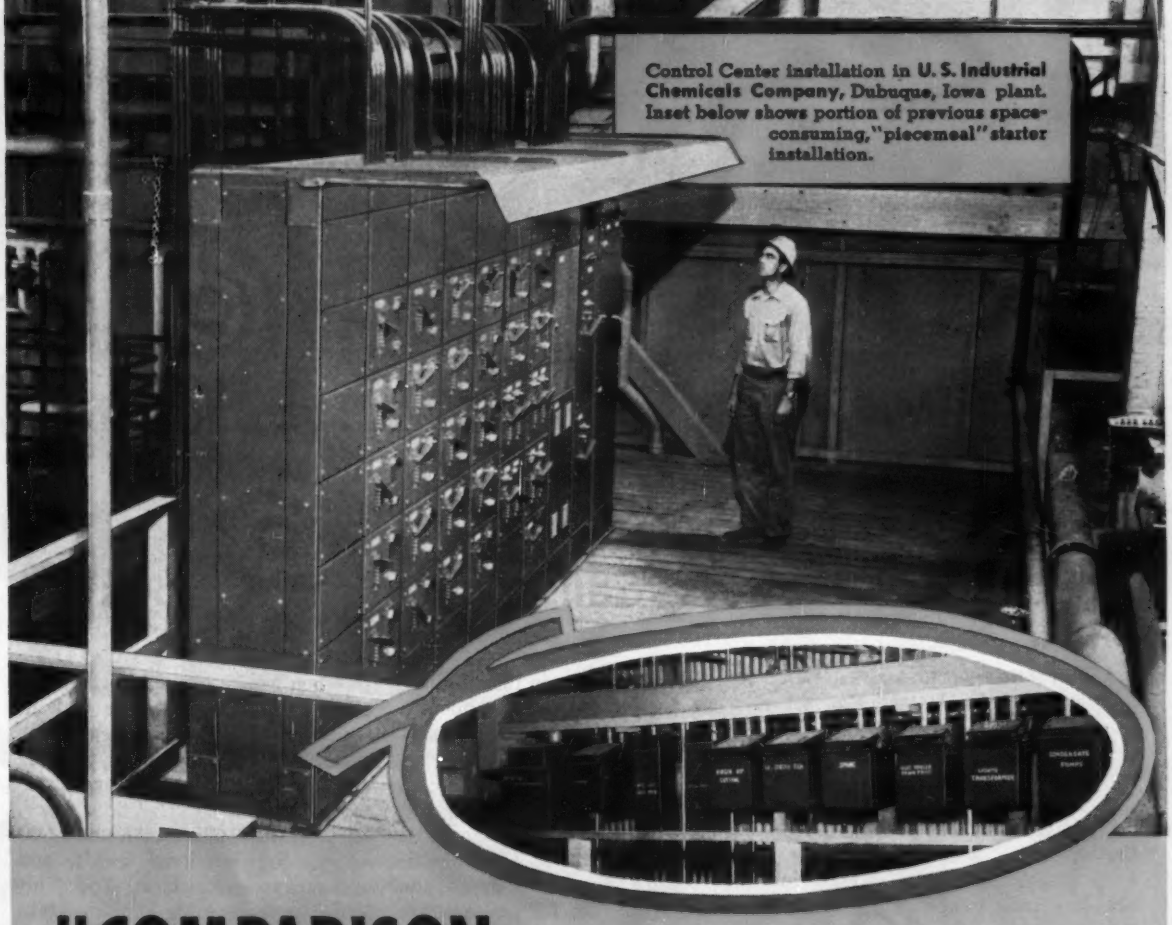
• The addition of 85,850 heating customers from 1957 to 1960, plus replacement of an additional 12,000 heating units.

• The sale of 86,550 ranges; 125,900 water heaters; 28,260 dryers; 11,490 incinerators; 6,720 refrigerators; a grand total of 356,770 new and replacement appliances and heating units.

The report goes on to state that Milwaukee Gas is spending $40 million in construction of new facilities to serve the doubled sales.

Reportedly, the Milwaukee market is wide open to all manufacturers of appliances and heating equipment. The utility staged a "marketing spectacular" last October to which it invited 120 executives of 67 manufacturing companies as the opening blast for its continuing drive.

(*More Selling on page* 100)



Control Center installation in U. S. Industrial Chemicals Company, Dubuque, Iowa plant. Inset below shows portion of previous space-consuming, "piecemeal" starter installation.

"COMPARISON convinced us that a SQUARE D Control Center offered us MORE!"

These design features make Square D your logical choice, too...

INCREASED SAFETY because bus bars are fully enclosed, rigidly supported and have ample cross section. Circuits are isolated by individually enclosed plug-in units. Disconnect handle designed for maximum operator protection.

FLEXIBILITY. Individual plug-in units or complete sections are easily added, removed or exchanged. Pushbuttons, pilot lights, and selector switches are readily added to unit doors.

INSTALLATION ECONOMY. All wiring channels are large and accessible from front without removing units. No "wire fishing."

SPACE ECONOMY, TOO. Up to six combination starters fit in a 20" x 20" x 90" section. Plug-in unit heights designed in space-saving increments of 3 inches.

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SQUARE D COMPANY

EASY AS 1...2...3

to service this 5000-hp, 2-pole motor

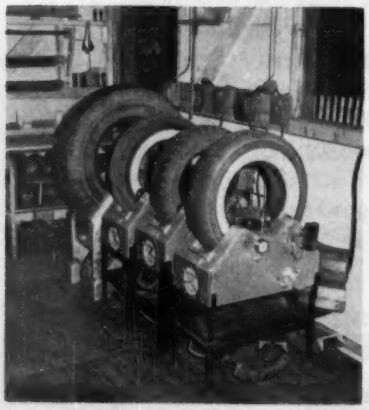
DRIVEN BY A 5-HP electric motor, this adjustable tire-stripping machine completely eliminates the work of one man

FOUR ELECTRIC MOLDS, rated 3.8 kw apiece, cure recaps in a maximum of 75 min. Power costs average 4¢ per kwhr

Recap for 18 Years, Calls Electric Way 'Best'

A. L. CHIODINI, Industrial Sales Engineer, Union Electric Co., St. Louis, Mo.

Almost 18 years of tire recapping and repairing experience has clinched Al Micke's convictions on the value of the electric way. Owner of Al's Vulcanizing Co., St. Louis, Mo., Al declares, "Electric heat has really paid off for me. My shop is cleaner, cooler, and maintenance costs are a thing of the past. We have installed the latest type of electric equipment and found that this equipment saved us time and labor costs. I believe this electric equipment has given us one of the best equipped shops in this area."



SECTIONAL MOLDS take variety of sizes. 240-v molds are rated 1.8 kw each

The dry electric heat produces a smoother cure than steam, says Micke. Electric molds are always at the same temperature. Steam sometimes has a tendency to develop a vapor lock, causing uneven mold temperatures. And because electrically cured recaps never fly off, the occasional carcass failures are the only cause of rejects. Furthermore, while steam sometimes tarnishes white wall tires, electric heat never has this adverse effect.

Although some recappers complain of improper cooling when molds are located in a drafty area, Micke reports that the thermostatically controlled electric molds stay within plus or minus 3F of the preset temperature. By contrast, when a steam boiler serves more than one mold, there is always the possibility that a newly started mold will take all the heat and lower the temperature on all the other molds.

Moreover, most steam plants lose a minimum of two days every six months while replacing flues. In eleven years of operation, Micke has had to replace only one heating element in his electric equipment. Finally, Micke reports that his shop is from 30F to 50F cooler than it would be with the same amount of steam equipment installed.

When Micke opened his own all-electric shop in 1945, he had already had six years experience with steam mold equipment. Starting with one recap mold, two sectional molds, and 400 sq. ft. of floor space, his operation has grown to 1,600 sq. ft., four sectional molds, and four recaps—all electric. Today his four-man work force handles 6,000 recaps a year and an estimated 4,000 repair jobs. "I am convinced," says Micke, "that electric equipment is better."

Special Casting Furnace

J. H. TARBELL, Industrial Engineer, Kansas City P&L Co, Kansas City, Mo.

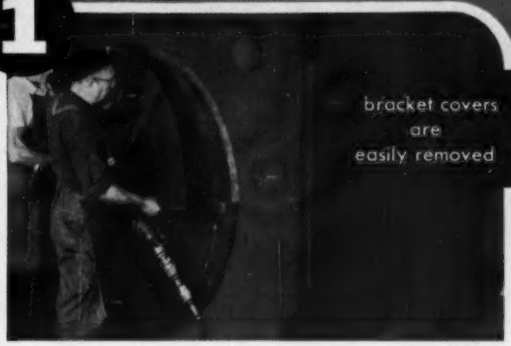
A 500-kw specially designed electric arc furnace has been built by Gold Foundry & Machine Works, Kansas City, Mo. It can bring a 3,000-lb heat of steel for castings up to a pouring temperature of 3,100F at an energy cost of $12 per ton. Consumption is 600 kwhr per ton of melted metal. The firm started operations some 15 years ago with a single-phase rocker-type furnace. This was converted to a direct arc unit with 300-lb capacity. Later this was replaced with a 700-lb unit.

NEW EQUIPMENT

to service this 5000-hp, 2-pole motor

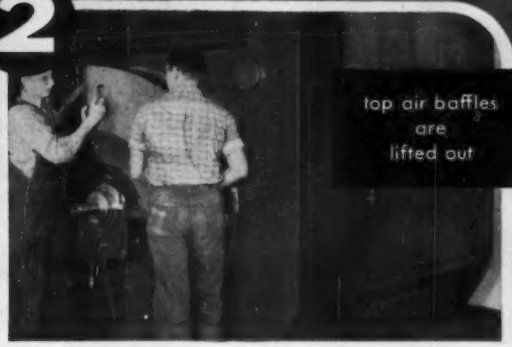
Elliott design speeds and simplifies maintenance

1



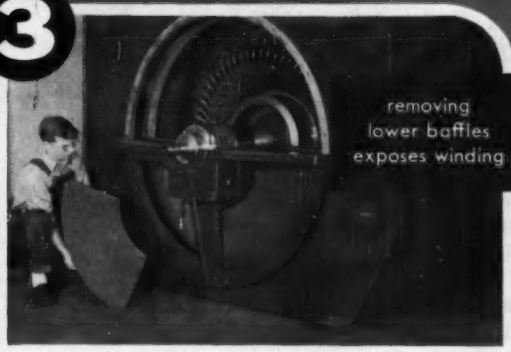
Maintenance procedure begins with removal of top bracket covers. Two men, without hoist or chain block, can handle the heaviest parts involved.

2

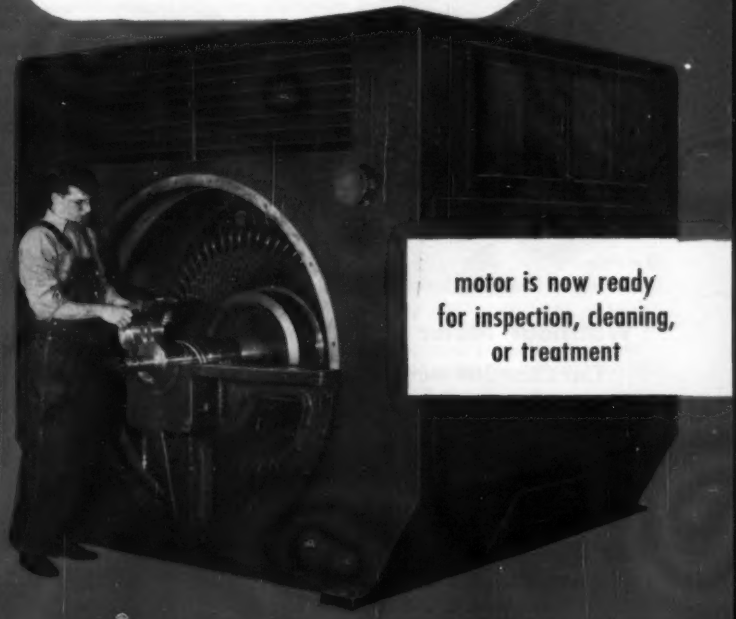


Inner air baffle is in four sections. Two upper sections are easily lifted through opening above lower half bearing bracket.

3



Covers on lower bracket give access to lower air baffles which are rotated into position above shaft, lifted out.



motor is now ready for inspection, cleaning, or treatment

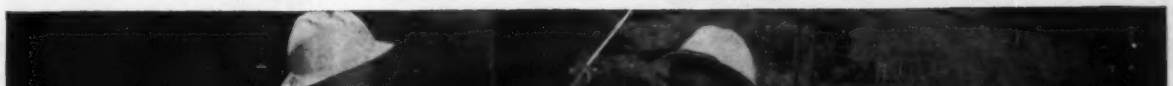
For more complete details on the maintenance of large 2-pole motors, see your Elliott representative or write Elliott Company, Ridgway Division, Ridgway, Pa. Ask for Reprint 64.

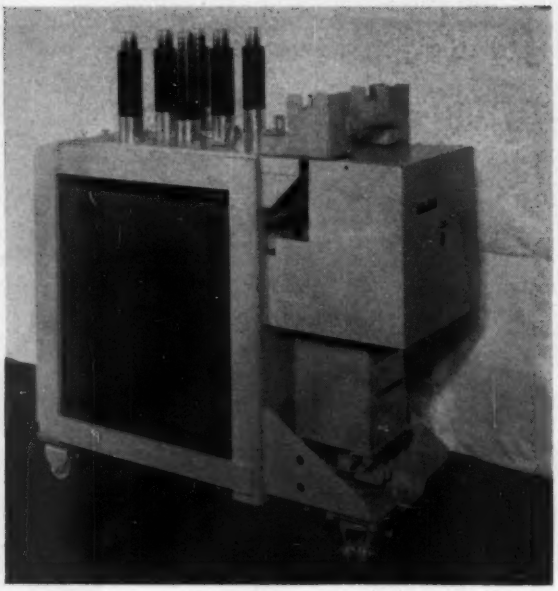
The ease of access illustrated here is typical of Elliott advanced designs for customers' special requirements. Upper and lower bearing sleeves are equally accessible. Actually, this motor is easier to service than most competitive machines *one-twentieth* its rating.

ELLIOTT Company

Ridgway Division, RIDGWAY, PENNA.

R 7-4





Power Circuit Breaker

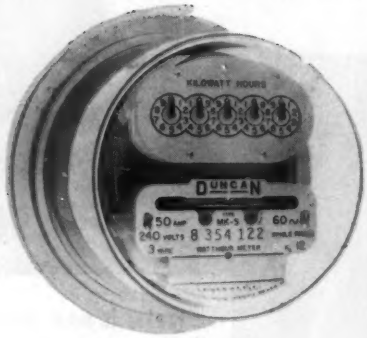
This magne-blast power circuit breaker, rated at 75 Mva and 1,200 amp, is now available with the manufacturer's light duty 4.16-kv metal-clad switchgear.

The new, higher rating is said to allow a 50% increase in interrupting capacity over existing 4.16-kv, 50-Mva metal-clad switch-gear, while not expanding space requirements. Features include improved insulation levels and positive mechanical interlock.

The 75-Mva breaker is reportedly suitable for use with correspondingly larger power supply transformers and unit substations.

The manufacturer claims it provides full interrupting capacity in five cycles or less.

General Electric Co, Schenectady 5, N. Y.



Watthour Meter

This Class 200 meter is an addition to the manufacturer's line of extended range Type MK watthour meters. It is said to provide capacity for measuring loads to 200 amp with "straight line" accuracy.

The new instrument supersedes the Type MF-SE Duncan single-phase meter. It incorporates such features as molded, arc-resistant insulation in the electromagnet; self-contained arc gaps to by-pass electrical disturbances; Alnico V permanent magnets to resist calibration changes; and microset adjustments, all of which are reportedly accessible from the front of the meter.

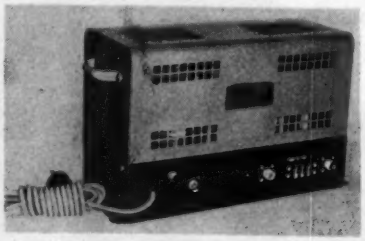
Duncan Electric Co, Inc, Lafayette, Ind.

Transient Converter

This transient converter is for use with turbine-type flowmeters. It accepts a sinusodial-type input signal of varying frequency and provides either an analog output for recorders and oscillographs or a digital output to counters and computers.

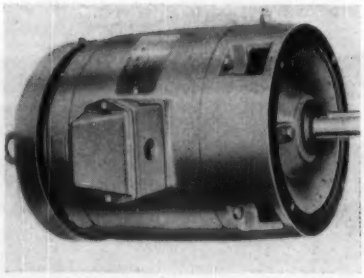
Input frequency range is from 0 to 600 cps, operating from a 500-ohm source impedance. Output is a 0 to 100-mv analog signal or a 10-v positive pulse (at 8 times the input frequency) to digital devices.

Unit has a reported short-term analog accuracy and linearity of ±0.5% and a long-term accuracy



of ±3%. Rise time is 10 millisec for a 40 to 600 cps step. Accuracy of the digital output is said to be absolute. The converter features plug-in sub-assemblies for easy maintenance.

Fischer & Porter Co, Hatboro, Pa.



Pump Motors

A line of vertical, solid shaft, P-base motors for vertical pump installations is offered in protected, totally enclosed, and explosion-proof enclosures. Motors are available in all sizes from 1 to 40 hp with normal thrust bearings and from 1 to 15 hp with high thrust.

Motors are designed for either outdoor or indoor use and are claimed to be corrosion-proof under the adverse conditions frequently found in the process industries.

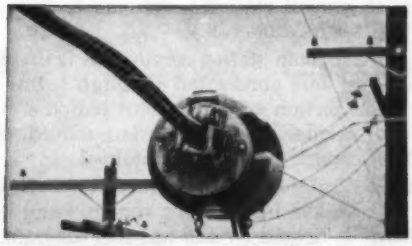
The shaft is sealed with a neoprene slinger. All motors have automatic lubricant flow and grease relief.

Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland 10, Ohio

(*More New Equipment on page* 106)

Linemen prepare to pass cable spinner by pole and fasten messenger as assistant on ground pulls spinner along the line. Neoprene withstands sunlight, temperature extremes and industrial fumes overhead . . . resists grease, ozone cracking and electrolytic attack *anywhere*. Neoprene jacketing gives cable maximum protection . . . reduces maintenance and replacement costs.

Cable spinning secures durable neoprene-jacketed secondaries for Portland General Electric Co.



Completed cable at upper left has been lashed to form a single unit, neater in appearance than former open-wire cross-arm construction. Portland General Electric estimates a 40 per cent reduction in accessories, and spun secondary permits long-span construction, which saves poles.

Over 150 miles of neoprene-jacketed cable installed since 1951

Portland General Electric Co. is making sure that maintenance costs will stay low on new overhead secondaries in expanding industrial and rural Oregon. Cable spinning is expected to bring sizable savings in future maintenance costs, compared with open-wire systems, and it cuts accessory costs as much as 40 per cent. Du Pont neoprene gives the ultimate in long-term cable protection... and its resistance to cutting and cold flow are especially important in an installation like this.

Since 1951 Portland General Electric has used over 150 miles of neoprene-jacketed cable. They report, "We've had five years of satisfactory service from neoprene-jacketed cable and expect many more."

This is another example of the confidence utilities place in neoprene—the synthetic rubber that resists sunlight, weathering, abrasion, industrial fumes, and virtually *all* other sources of jacketing failure. Ask your supplier about long-lasting wire and cable jacketed with neoprene. It's available in voltage ratings to meet your requirements.

NEOPRENE

The rubber made by Du Pont since 1932

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

FREE! THE NEOPRENE NOTEBOOK. Every issue contains interesting stories about products made with neoprene. Actual case histories give you the facts about neoprene's longer service life. Clip coupon to get on the mailing list. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. EW-1, Wilmington 98, Delaware.

*Name*_____ *Position*_____

*Firm*_____

*Address*_____

*City*_____ *State*_____

New plant uses for station

Southern California Edison Co. Saves Building Costs at New Redondo Station

Cut costs . . . maintain power continuity! These were the big considerations at Southern California Edison Company. The use of outdoor station auxiliary switchgear helped in cutting overall costs. And the carefully planned circuit schemes described here help in maintaining continuity of service for the station auxiliaries.

First step in assuring power continuity was setting up two independent power sources for auxiliaries.

(1) *An auxiliary generator direct-connected to the main generator shaft.* Supplies main auxiliaries during normal operation . . . provides a power source independent of system disturbances.

(2) *A local 69-kv line through a step-down transformer bank.* Provides a reserve and start-up source, and supplies general station requirements such as soot blowers and spare exciter.

The 4160-volt main station service bus is divided into East and West bus connected through a bus section breaker. Each section supplies about half the auxiliary power requirements. If either bus is removed, approximately 65% capacity can be maintained.

The Allis-Chalmers outdoor 4160-volt switchgear is rated at 250,000-kva interrupting capacity and is physically split as indicated by the one-line diagram. Three types of protection are provided: overload, undervoltage and fault.

Motors are tripped off the line and an alarm is sounded if heavy overload occurs. No alarm is given on light overload.

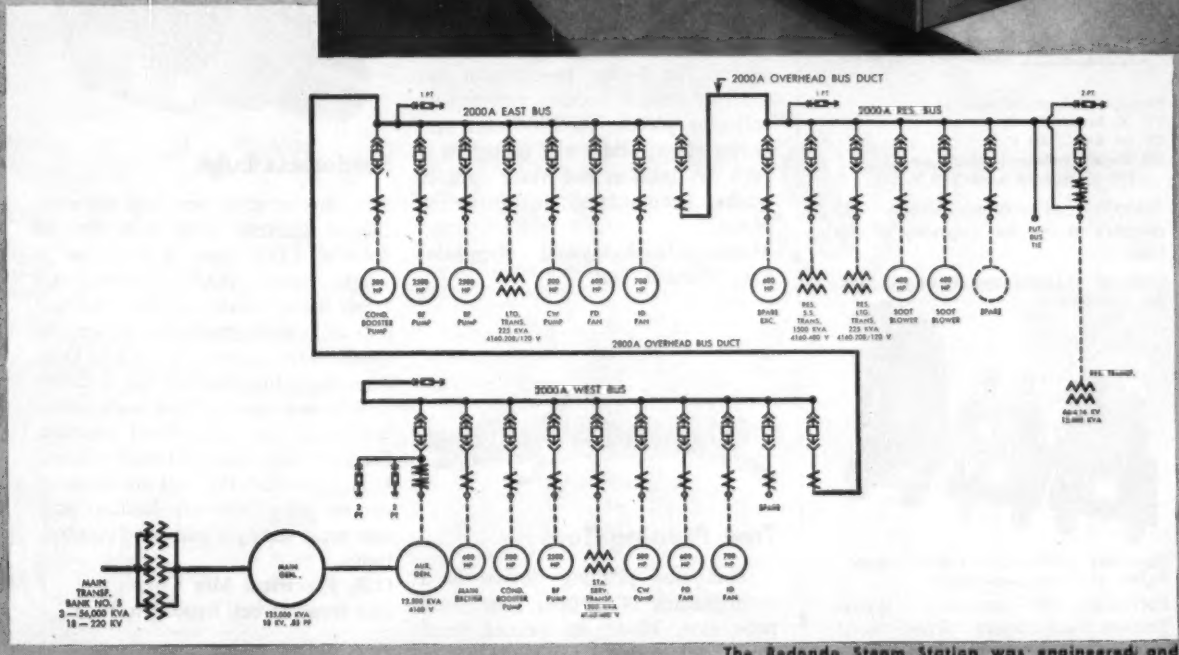
An undervoltage condition on main bus (East and West buses combined) will initiate an automatic throw-over from the auxiliary generator to the reserve supply.

In the event of a fault in the generator circuit or in the generator, provision is made for automatic transfer from auxiliary generator to reserve source.

for Progress in Switchgear **ALLIS-**

outdoor switchgear auxiliaries

Allis-Chalmers engineers worked in close cooperation with Stone & Webster Engineering Corporation and Southern California Edison Company engineers on this project. It is one of many station auxiliary switchgear lineups built by Allis-Chalmers. For an answer to your switchgear problems, call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



The Redondo Steam Station was engineered and constructed by Stone & Webster Engineering Corporation.

If there's a fault on either the East or West bus, the section is automatically isolated so disturbances will be kept to a minimum.

During normal operations it is possible to transfer to the reserve supply by first opening the normal supply — then closing the reserve bus tie.

To provide added flexibility there is also provision for make-before-break manual transfer from normal to reserve power supply by closing the reserve bus-tie breaker, after synchronizing the two sources of power, and then opening the normal supply breaker.

CHALMERS

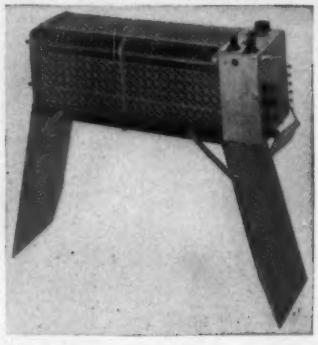
A-C ALLIS-CHALMERS

A-5217

THE STATES COMPANY

RESISTANCE TYPE RELAY LOADS...

Accurate • Quick • Safe

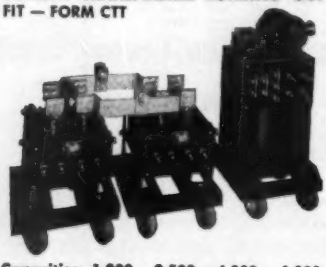


Ohm-spun LOAD—TYPE WRL

Made in 3 loads. Capacities:
(1) 30 Amp. 120 V.
(2) 60 Amp. 120 V.
(3) Double voltage load: 50 amp. 120 V. and 25 Amp. 240 V.

Smooth adjustment from .05 ampere to the full capacity of the load.

CURRENT TRANSFORMER LOADING OUTFIT — FORM CTT



Capacities: 1,000 - 2,500 - 4,000 - 6,000 10,000 - 12,000 amperes.

Portable or stationary types. Smooth adjustment from near zero to full capacity of the load.

When you're using STATES Testing Equipment . . . You're using the finest!

THE STATES COMPANY
19 New Park Ave., Hartford, Conn.

Please send me further information on
☐ Test Tables ☐ Resistance Loads
☐ Test Blocks

Name.....Title.....

Firm Name.....

City.....Zone.....State.....

Air Cleaners

A line of electric air cleaners, to be used with unit or central air conditioners in commercial buildings is now in production. They are reported to remove 90% of all airborn particles in the 20 to 10^{-4} micron range when handling 333 cfm. Operating from a 110-v ac source, the 2-stage precipitator has a 13-kv ionizer section and 6.5-kv collector plates. A 1300-cfm unit draws 50 w; additional units, 10 w each. A built-in hot-water sprayer washes accumulated dirt from the plates.

Minneapolis-Honeywell Regulator Co., Wabash, Ind.

Tree Pruning Tool

This tree pruning device is a combination of pruner head and pole saw, blade on pruner head for clipping small branches up to 1 in. in diameter, and saw for larger limbs up to 5 in. in diameter.

Pruner head is No. 11 Telephone tree pruner head. Saw blade attachment is made of Swedish charcoal steel. Cataloged as No. 2011, it is for use with the manufacturer's No. 102 6-ft head pole and No. 103 6-ft extension pole, as well as his No. 1P12 unjointed pole.

Seymour Smith & Son, Inc Oakville, Conn.

Dust Collector

A dust collector, Model 123, has been designed to handle heavy-duty continuous grinding and other high-dust volume sources. The Model 123 has a dust storage capacity of 10 cu ft and a filter area of 300 sq ft. Reportedly, its 5 hp motor moves approximately 2,000 cu ft of air per min. through an 8-in. inlet at speeds of more than a mile per min. Static pressure is 3½ in. of water. Cloth filters are chemically treated for spark resistance and sealed against leakage. Filters, motor and blowers are said to be easily reached through removable doors. The motor is internally mounted. Height, 115 in.; width, 62¼ in.; depth, 26 in.

Torit Mfg Co, Dept KP
287 Walnut St., St. Paul 2, Minn.

Solderless Lugs

A line of solderless lugs for conductor diameter sizes from No. 14 solid to 1,000 Mcm is available in single barrel, double barrel, and triple barrel models in one, two and four-hole mounting styles, depending on the sizes selected. Known as O.Z. Shurelugs, the sizes for No. 4 cables and larger can be had with either hex-head or allen-head screws. Smaller sizes have fillister screws. U.L. approved, the lugs are made of copper alloy, and are said to provide great strength and good conductivity.

O.Z. Electrical Mfg Corp
262 Bond Street, Brooklyn, N. Y.

Textile Motors

This "Clean-Flo" line of totally enclosed, fan cooled, self-cleaning textile motors is reported to be completely interchangeable with existing NEMA motors. Said to be lint free, the motors are available with the shaft brought out either end. Special construction, with suspen-

(*Continued on page* 110)

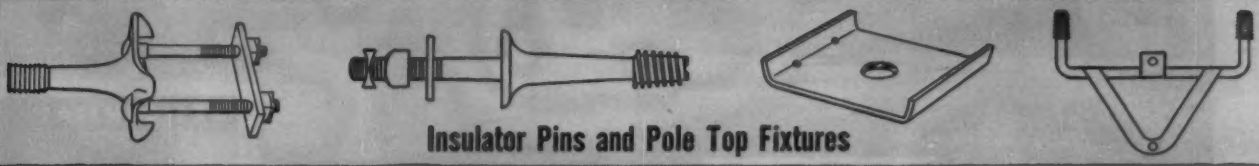
Standard Pole Line Hardware

4,000 items . . . from arm to anchor

AVAILABLE FROM HUBBARD

And in a variety of materials. On many Hubbard items, you may specify Galvanized Steel, Galvanized Corten, Aluminum or Copper; as determined by the requirements of each installation.

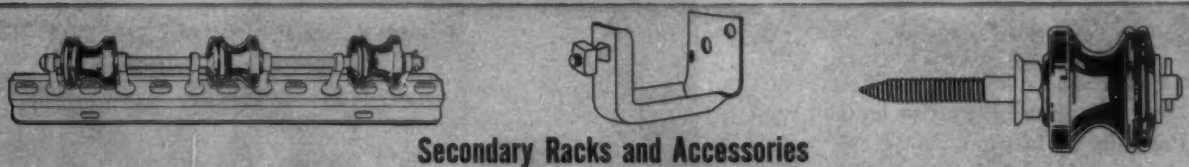
Hubbard Pole Line Hardware either meets or exceeds the standards set by the leading trade associations and the largest operating companies.



Insulator Pins and Pole Top Fixtures

Insulators and Clevises

Transmission Hardware



Secondary Racks and Accessories

Pole and Crossarm Brackets

Wireholders and House Brackets

Street Lighting Standards
Equipment, Brackets

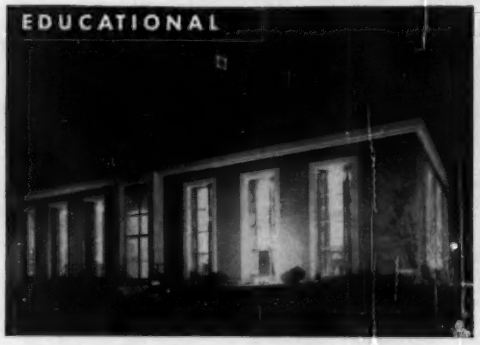
Quality . . . for more than a century

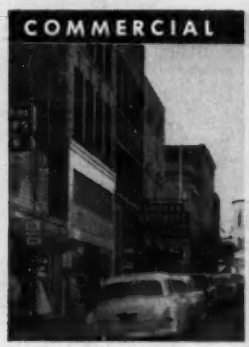
HUBBARD AND COMPANY

Pittsburgh 1, Pa. • Chicago 50, Ill.
Oakland 8, Calif. • Dallas (Plano), Texas

Here's how **WEST PENN** builds markets and load

Charles M. Fife, Manager of Area Development, directs the program aimed at attracting new industry to Western Pennsylvania.

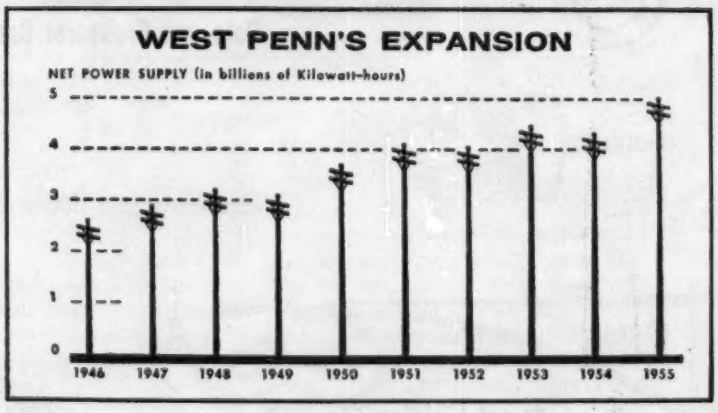




A major function of West Penn's Marketing is its broad Area Development Program. It features "one-stop" service which provides industries—seeking locations for new or expanded operations—full information to guide sound plant location decisions.

Used as one basic means to meet West Penn's needs for the growth and economic development of its service area, the Program continues as a big factor in drawing many industries to Western Pennsylvania. These create jobs—and affect load building in all West Penn markets: industrial, residential, farm, commercial, institutional and municipal.

The Area Development Program has contributed to the growth of West Penn's load from 2,641,009,276 KWH in 1946 to 5,000,654,072 KWH in 1955, as shown on the chart at right.



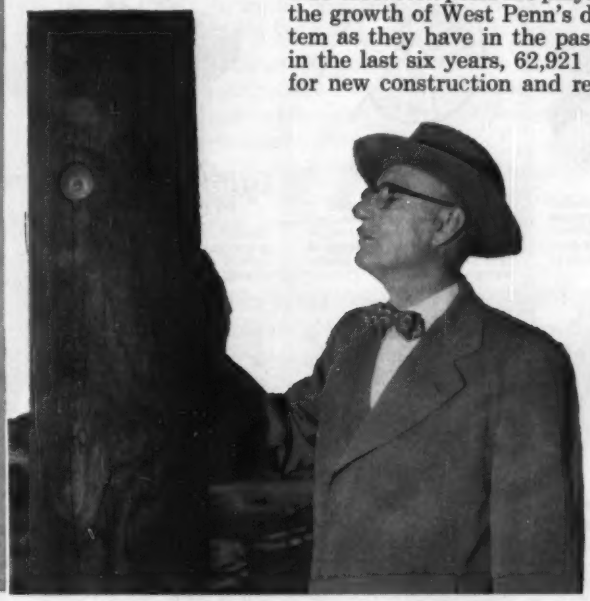
POWER COMPANY

through area development

"As markets and load grow, pressure-creosoted poles are playing a big role in our construction program"

says **Fred A. Ashbaugh,** *Supervisor of Lines Maintenance*

West Penn Power began using pressure-creosoted pine poles in 1925 and has approximately a quarter million in service today. West Penn Power has received highly satisfactory service from its pressure-creosoted poles. The average life is 35 years. So pressure-creosoted poles are playing a big part in the growth of West Penn's distribution system as they have in the past. For example, in the last six years, 62,921 have been used for new construction and replacement.



Choose creosote—the preservative with a past and a future!

For more information on pressure treatment and USS Creosote—the quality preservative—write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa., or call the nearest United States Steel Chemical Sales Office.

USS CREOSOTE

Sales Offices in Pittsburgh, New York, Chicago, Cleveland, Salt Lake City and Fairfield, Alabama

UNITED STATES STEEL — USS CREOSOTE

7-243

UNITED STATES STEEL

IT PAYS TO HAVE
HUBBELL
GOOD CONNECTIONS
for greater plant
safety and security
REPLACE NOW
WITH SUPER
Twist-Lock®
featuring Screwless
Pressure-Grip Termin-
als and Dead Front
2 PC.
DEAD FRONT CAP
For Greater Safety
Dead front completely encloses cap, keeps out foreign particles that might short-circuit contacts. No need for fibre insulating disc, therefore no extra parts to lose or forget to use.
TERMINALS ARE
LOCKED IN
Terminals are pressure-gripped in place, can't pull out. Conductors are confined in their individual pockets, can't spread. No danger of flash over. Design assures greater wiring uniformity.
GREATER BLADE RIGIDITY
For Greater Strength
Stronger, rigidly supported contacts withstand hard knocks, retain uniform alignment and maintain polarity.
HEAVIER ARMOUR
BUT MORE COMPACT
For Longer Life,
Safer Performance
Rugged protective steel shell protects inner construction, resists the roughest industrial usage.
IMPROVED CORD GRIPS
RELIEVE STRAIN
FROM CONTACTS
Powerful cord grip design provides pull-proof pressure grip on cable.
SCREWLESS TERMINALS
SPEED WIRING...
CUT COSTS
No awkward binding posts. 2-pc cap and connector body can be wired in ⅓rd the time, thus reducing installation costs.
Interchangeable with Regular Twist-Lock units of equal rating.
Folder tells the complete story. Write today.
HARVEY
HUBBELL, INC.
HIGHEST QUALITY
WIRING DEVICES • MACHINE SCREWS
DEPT. E-2 BRIDGEPORT 2, CONNECTICUT
WIRING DEVICE
WAREHOUSE LOCATIONS
ASSURE NATIONWIDE
STOCK AVAILABILITY
Bridgeport 2, Connecticut
State and Bostwick Streets
Chicago 7, Illinois
37 South Sangamon Street
Los Angeles 12, California
103 North Santa Fe Avenue
San Francisco, California
1675 Hudson Avenue
Dallas 7, Texas
1111 Dragon Street

Textile Motors

(*Continued from page* 106)

sion mounting and motor-mounted disc brakes, for spinning frame service is also available. Additional details are available from Bulletin 1850.

Louis Allis Co., Milwaukee, Wis.

High Voltage Starter

A type ZHA (2,200-4,800 v) starter is said to be accessible from the front, mountable directly against a wall or in double rows, and only 30 in. deep.

It is self-contained, with a control transformer supplying low voltage for pushbutton circuits. Only one incoming feeder is required when starters are ganged. The ZHA is furnished in three interrupting ratings for squirrel-cage, synchronous and wound rotors. Class E1—50,000 kva; Class E2 with current-limiting fuses and high interrupting capacity contactor—at 2,300 v: 150,000 kva, 3-phase, 60,000 RMS amp asymmetrical; at 4,800 v: 250,000 kva, 3 phase, 60,000 amp asymmetrical. Valimitor—may be used on a bus of unlimited short circuit capacity, through use of a contactor with an interrupting rating of 50,000 kva, and reactors which limit and fault current to a maximum of 25,000 kva.

Square D Co, Electric Controller & Mfg Div, Cleveland 28, Ohio

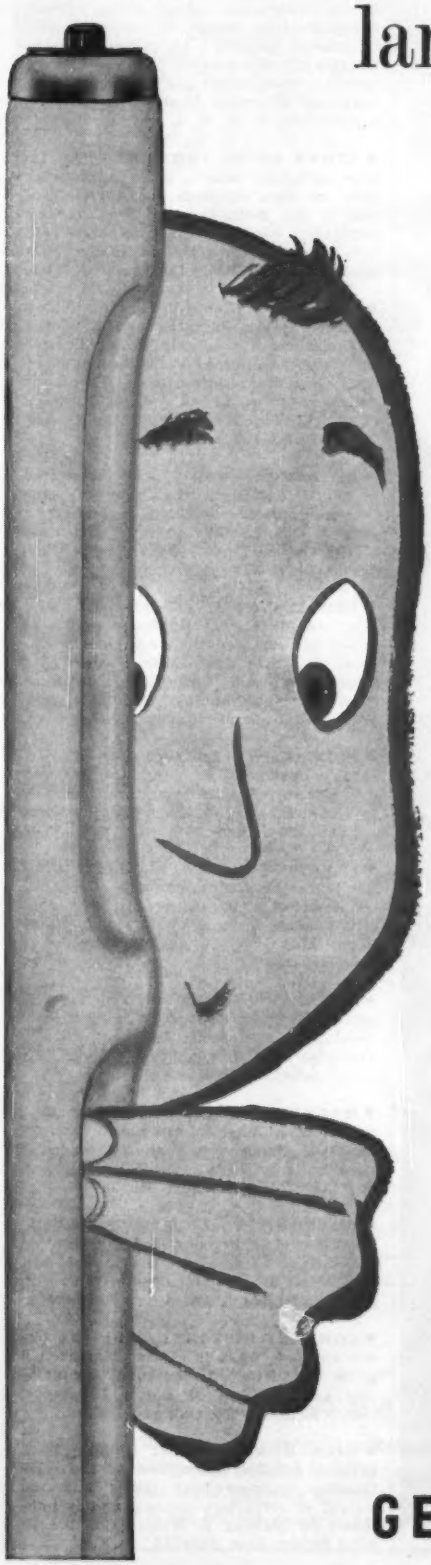
Emergency Lighting System

A centralized emergency lighting system, said to constantly supervise itself, has been designed to provide emergency illumination in public and private buildings.

The new system reports any fault by flashing lights and buzzers. In operation it is reportedly instantaneous and automatic. Emergency lights go on when regular power fails, and go off when power is restored. A special 32-v, nickel-cadmium battery is automatically recharged and kept at full capacity by a constant trickle of charging current.

Standard Electric Time Co
Springfield, Mass.

The shape of fluorescent lamps to come



New General Electric "Power-Groove" discovery means more light for you . . . at less cost

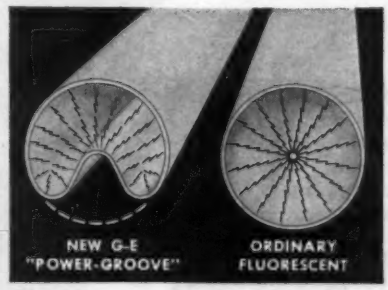
Look at this new kind of fluorescent lamp. It's the General Electric "Power-Groove"—a revolutionary new development created by G-E engineers. It not only gives more than 2½ times as much light as the 8-foot slimline (most widely used 8-foot fluorescent), and lets you save more than 20% on your initial cost, and has fewer parts to maintain . . . but it even *looks* different—for a reason.

It's the grooves in General Electric "Power-Groove" Lamps that make possible a greater increase in light-per-foot than all the combined increases made since General Electric introduced fluorescents in 1938!

The new G-E "Power-Groove" Lamps are the popular 8-foot length (200-watts) with 4-foot sizes also available and 6-foot sizes later. They are Rapid Start lamps that need no starters—and are to be used in fixtures and circuits designed especially for them.

IF YOU'RE PLANNING a new lighting installation—you'll want to investigate G-E "Power-Groove". New G-E "Power-Groove" lamps are going into some installations right now! You'll be able to buy them . . . and the fixtures . . . in quantity by midsummer, so get the whole story now. Call your local G-E Lamp Supplier or write: General Electric Co., Large Lamp Dept., Nela Park, Cleveland 12, Ohio.

COMPARE! The new G-E "Power-Groove" construction (left) works 3 ways to give more light. One: it places some of the light-producing phosphors closer to the energizing area in the center of the lamp. Two: it presents a greater surface area which permits the generation of more ultraviolet rays to activate the phosphor. And three: it makes the lamp run cooler—which permits a higher current design and gives you more light per watt.



Progress Is Our Most Important Product

GENERAL ELECTRIC

What Makes RT&E Transformers Better?

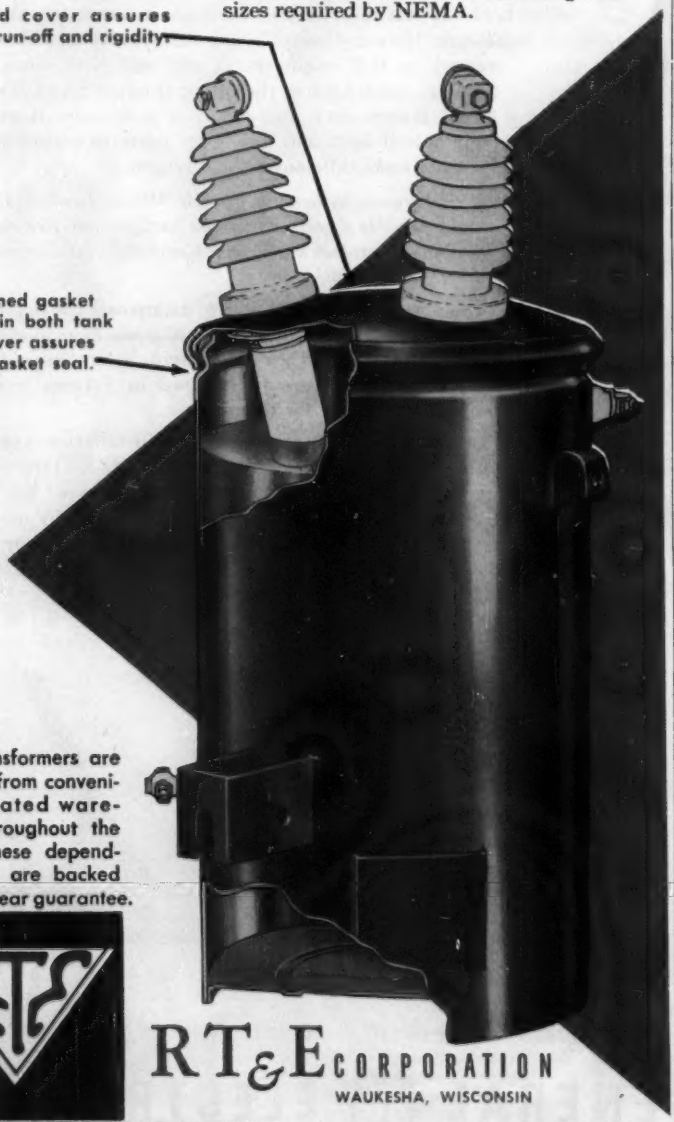
SUPERIOR TANK CONSTRUCTION for longer Trouble-free life

RT&E tanks get three coats of modified alkyd paint — two coats flowed on, final coat sprayed — and each coat individually baked. This thoroughness provides the highest type of weather resistance. Arc welding of all seams, brackets and mounting pads, eliminates moisture traps and corrosion.

These heavy gauge steel tanks, with circular grooved bottoms, assure extra strength. Tin plated, locked type terminals accommodate either copper or aluminum conductor in the full range at sizes required by NEMA.

Domed cover assures water run-off and rigidity.

Preformed gasket surfaces in both tank and cover assures tight gasket seal.



RT&E Transformers are available from conveniently located warehouses throughout the nation. These dependable units are backed by a five year guarantee.

RT&E CORPORATION
WAUKESHA, WISCONSIN

SUPERIOR TANK CONSTRUCTION — *Another reason why* RT&E *is better.*

CATALOGS—BULLETINS

• **LIGHTING BALLASTS:** GED-2416B is the designation of a newly revised cross-reference guide for selecting GE fluorescent ballasts. 12 pages, contains information for general line, rapid start, slimline, instant-start, and circline ballasts—all 60 cycle. General Electric Co, Schenectady 5, N. Y.

• **EPOXY RESIN ADHESIVES:** An 11-page technical bulletin gives engineering data on high strength epoxy resin adhesives for metal-to-metal bonding and honeycomb sandwich construction. Available from Adhesives & Coating Div, Minneapolis Mining & Mfg Co, Detroit 2, Mich.

• **CABLES:** "Nepco-Lok Interlocked Armored Cable, Supports and Fittings", is the name of a catalog giving illustrations and descriptions of the various types of the manufacturer's armored cables for voltages up to 15 kv. Write National Electric Products Corp, Gateway Center, Pittsburg 22, Pa.

• **RESEARCH LAB:** An illustrated brochure describes the new research laboratory of the National Carbon Co at Parma, Ohio. Published by Union Carbide & Carbon Corp, 100 E. 42nd St, New York 17, N. Y.

• **POWER SYSTEMS:** Two bulletins have been issued to assist in the planning of power systems and their equipment. Entitled "How to Save With System-Wise Experience," and "Information on Your Power System Planning." Available from Worthington Corp, Harrison, N. J.

• **PORCELAIN INSULATORS:** A new catalog covers all the standard wet and dry process porcelain insulators furnished by Universal Clay Products Co, 1528 First St, Sandusky, Ohio

• **ELECTRIC POWER PLANTS:** "Electric Power Plants" is the name of a booklet describing the engineering and construction services available from Fluor Corp, Ltd, 2500 S. Atlantic Blvd, Los Angeles, Calif.

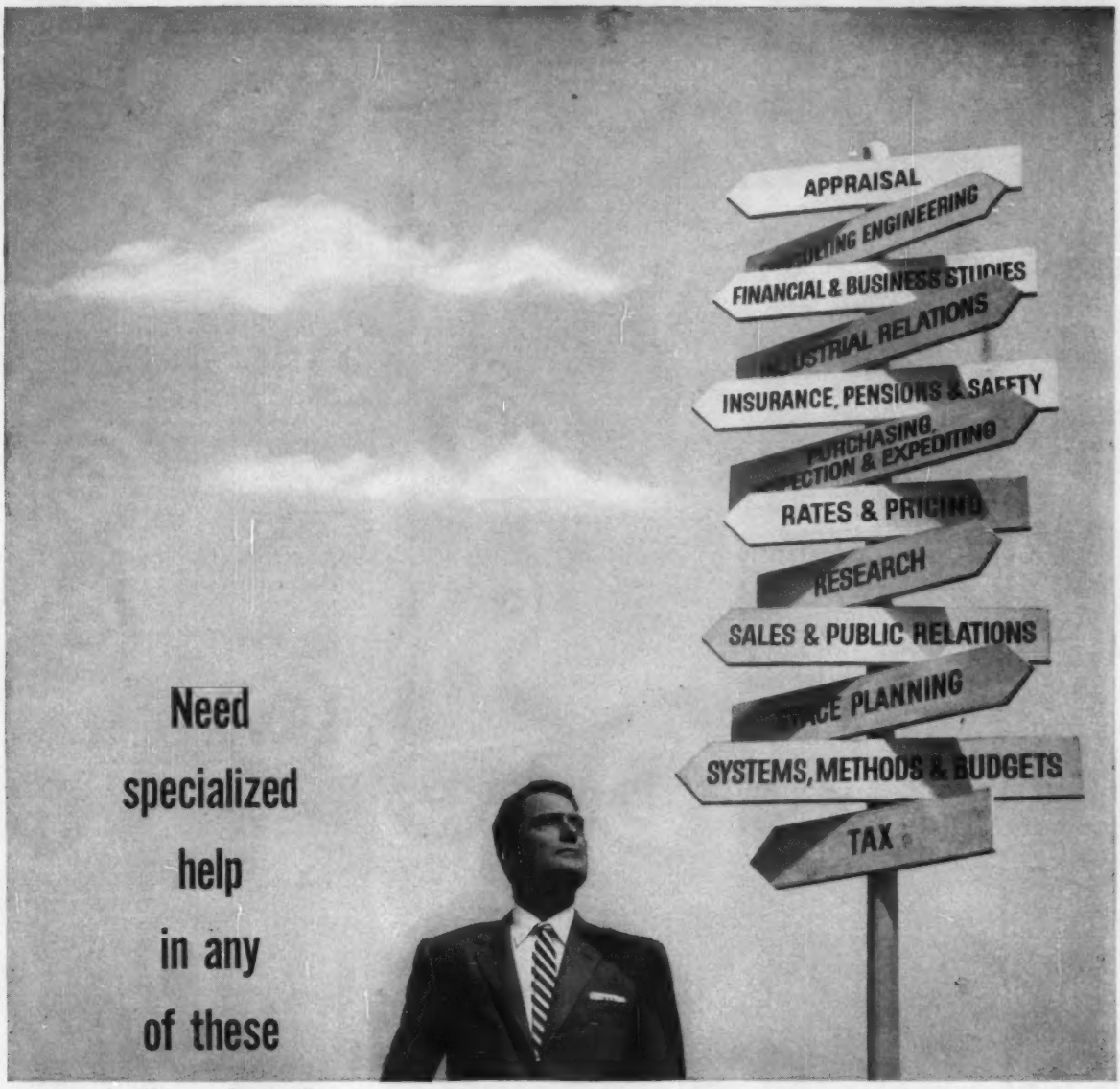
• **MOTORS:** A bulletin featuring the new series 254-U All-Weather re-rated motors developed by Robbins & Myers, Inc, is available from the company's motor division in Springfield, Ohio.

• **MAGNET WIRE:** A 4-page folder gives the electrical, physical and chemical properties of the newest enameled magnetic wire made by Wire & Cable Div of Electric Auto-Lite Co, Port Huron, Mich.

• **EMERGENCY LIGHTING:** Exide's "Lightguard Emergency Lighting Unit" is the subject of a 4-page brochure issued by Electric Storage Battery Co, 42 S. 15th St, Philadelphia 2, Pa.

• **COMPANY HISTORY:** A 34-page booklet, entitled "This is Kaiser Engineers", gives the history, background, organization and facilities of Kaiser Engineers, Henry J. Kaiser Co, Oakland 12, Calif.

• **KILN HEAT LOSSES:** Bulletin R-43 gives a detailed description of the relationship between heat losses and the weight of refractory linings, and is published by Babcox & Wilcox Co, 161 E. 42nd Street, New York 17, N. Y.



Need specialized help in any of these directions?

The modern approach to solving special operating problems is to call in specialized help. That way you don't divert your own key personnel from regular duties. You don't overburden your regular staff. And you save a maximum of payroll dollars. Backed by long experience in solving similar problems for utility companies throughout the United States and abroad, Ebasco gets to work promptly, gets the job done right and economically while your normal flow of routine operations continues.

Ebasco technicians are at your call anywhere and anytime you need them, for assignments large or small in any phase of utility operation.

ENGINEERS · CONSTRUCTORS
EBASCO
BUSINESS CONSULTANTS

NEW YORK · CHICAGO · DALLAS
PORTLAND, ORE. · WASHINGTON, D.C.

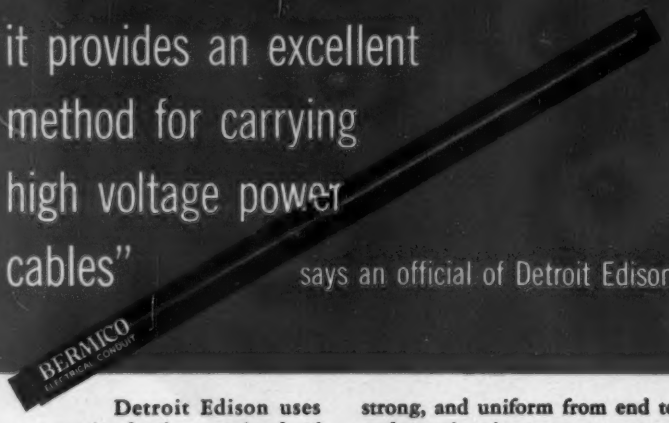
COMPLETE ENGINEERING AND CONSTRUCTION SERVICES

In addition to assisting with operating problems, Ebasco offers a complete engineering and construction service for building new facilities or additions to present installations—from initial planning to actual operation of the plant. A half century of experience in the electric power industry stands behind this service.

For a complete outline of the services Ebasco offers to the public utility industry, write for our booklet, "The Inside Story of Outside Help." Address: Ebasco Services Incorporated, Dept. M, Two Rector St., New York 6, N. Y.

BERMICO® electrical conduit is used by Detroit Edison because...

"it provides an excellent method for carrying high voltage power cables" says an official of Detroit Edison



Detroit Edison uses carload after carload of Bermico Conduit to carry high voltage cables supplying continuous power to the automotive center of the world.

Made to precision standards from cellulose impregnated with coal tar pitch, Bermico Conduit is alkali-resistant, acid-resistant, strong, and uniform from end to end—yet low in cost.

Leading electrical contractors and public utilities everywhere are getting the maximum protection and ease of installation that it provides. You can, too, by always specifying Bermico Conduit. Immediate shipment of all sizes and fittings guaranteed.

Distributed by WESTINGHOUSE Electrical Supply Company
Offices in principal cities

BROWN COMPANY
Berlin, New Hampshire
GENERAL SALES OFFICE: 150 CAUSEWAY STREET, BOSTON 14, MASS.

TECHNICAL LITERATURE

RESISTANCE WELDING—Volume 1 of the 3rd Edition of RWMA's Resistance Welding Manual is now available. Divided into two sections, this 350-page, hard cover book contains useful photographs, sketches, charts, diagrams and tables. The first section is an introduction and covers the fundamentals of resistance welding. The second section is devoted to the techniques of applying the various fundamentals discussed in Section 1. Price is $3.50 per copy. Resistance Welder Manufacturers' Ass'n, 1900 Arch St, Philadelphia 3, Pa.

GAS & OIL EQUIPMENT—The Gas and Oil Equipment List of UL has recently been published. The 263-page volume contains two sections, which are divided as follows: Section I includes devices, materials and systems which have been examined with reference to fire hazards and such accident hazards as are involved in the class under which they are listed; Section II includes products classified as to fire hazard only. No charge. Address Underwriters' Laboratories, Inc, 161 Sixth Ave, New York 13, N. Y.

CTI PUBLICATIONS—Cooling Tower Institute, 446 Emerson Street, Palo Alto, Calif., has issued the following:

- ATP-105, "Acceptance Test Procedure", which describes methods and instrumentation for conditions and measurements in determining water-cooling capability of mechanical-draft industrial towers, 4 pages, price $1.00
- STD-103, "Redwood Lumber Specifications", in two parts, covering CTI Grades of Redwood Lumber and Framework Design Data, 5 pages, $1.00
- WMS-104, "Wood Maintenance for Water Cooling Towers", describes observations made during annual inspections of operating towers from 1951 through 1955. Replaces Bulletin TSC-302. $1.50
- PRM-101 brochure, describes CTI organization, major committee projects, membership roster and officers. No charge.

CABLE OPERATION—"Cable Operation 1954" is the title of a joint report issued by Committee on Power Distribution, Association of Edison Illuminating Companies, and Transmission & Distribution Committee, EEI. It covers operating experience with high-voltage (above 7.5 kv between phases) paper-insulated cable, joints and terminations during 1954 as reported by 16 contributors. Publication No. 56-8. Prices: To members $0.70; to non-members in U.S.A. $1.75; and to foreign countries $1.85. Prices include postage. Write Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

VOCATIONAL TRAINING—"Your Opportunities in Industry as a Skilled Craftsman" is the name of a 32-page booklet which covers the importance of apprentice training and cites the immediate values of vocational-industrial and industrial arts training in helping youngsters get a head start in skill development. No charge, write Education Dept, National Association of Manufacturers, 2 E, 48th Street, New York 17, N. Y.

STEEL DATA—Revised edition of the 256-page pocket-size Ryerson Steel Data Book gives information on machining and fabricating, specifications and tolerances, weights and dimensions, elements and safe loads, tables, definitions and general data. Free, write Joseph T. Ryerson & Son, Inc, Box 8000-A, Chicago 80, Ill.

Line construction bodies for light to heavy-duty. Crew compartments optional. Efficient tool compartments and drawers.

Bodies for truck driven air compressors. Designed to accommodate hose reels, tapping machines, jack hammers, etc.

Service bodies for chassis up to 1½ ton. Lengths, 72", 75", 84", 90" and 102".

Hydraulic Derricks designed for front or rear mounting. Capacities to 12,000 lbs.

Light-duty power operated derricks for front or rear mounting. Operating range of 146°.

Ladders to 40' with all phases completely hydraulic. Pump actuated by P.T.O. or separate engine drive with electric starter.

Mechanical Ladders expertly engineered and counterbalanced for effortless handling. Maximum heights from 23' to 40'. Swings 360°; angles to 72°.

Portable mechanical and hydraulic earth borers with optional rotation.

Wide variety of pole and reel trailers. Standard and special. Many optional features.

Hydraulic jacks, controlled from rear of truck. Rigid mounted or patented Holan self-stowing types.

Hydraulic towers with rotary, stationary, or transverse platforms. Exclusive box-girder telescoping mast.

Indianapolis Power & Light Company uses Holan tower for installing 240-pound luminaire 33 feet above ground.

TOWER OF STRENGTH

Holan hydraulic towers make high-up work safe and easy . . . like working on the ground.

A powerful, telescoping double-acting cylinder, supported by a telescoping box section, smoothly lifts the platform into the sky. Every movement of the platform — up or down, around or sideways — is controlled by push-buttons from the platform or the cab.

For crew safety, there's a 3-foot side railing and insulation throughout. All told, you have the last word in convenience, safety, and easy maintenance.

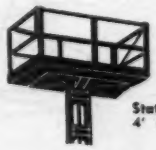
If you work high up, get the low-down on Holan hydraulic towers.

THREE TYPES

Transverse platform — moves laterally, 11 feet* either way. 4' by 7' platform.

*Can be made to move laterally 14 feet for special applications.

Rotary platform — rotates 330°. 4' by 11' platform.



Stationary platform. 4' by 7' platform.

Three models for each type — maximum heights of 17', 23'6" and 30'. Can also be furnished for 35' height. All towers collapse to about 10'3".

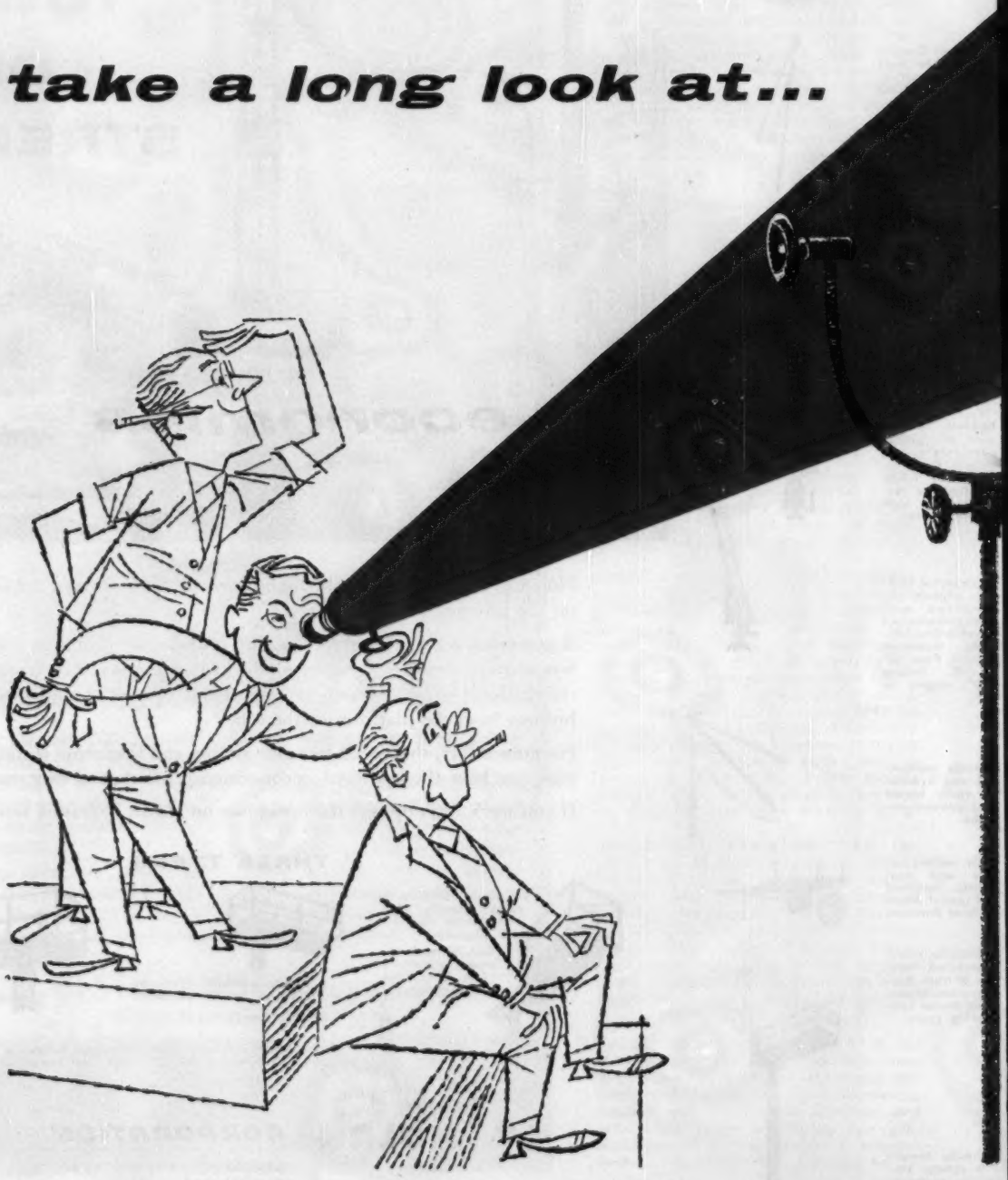
J.H. HOLAN CORPORATION

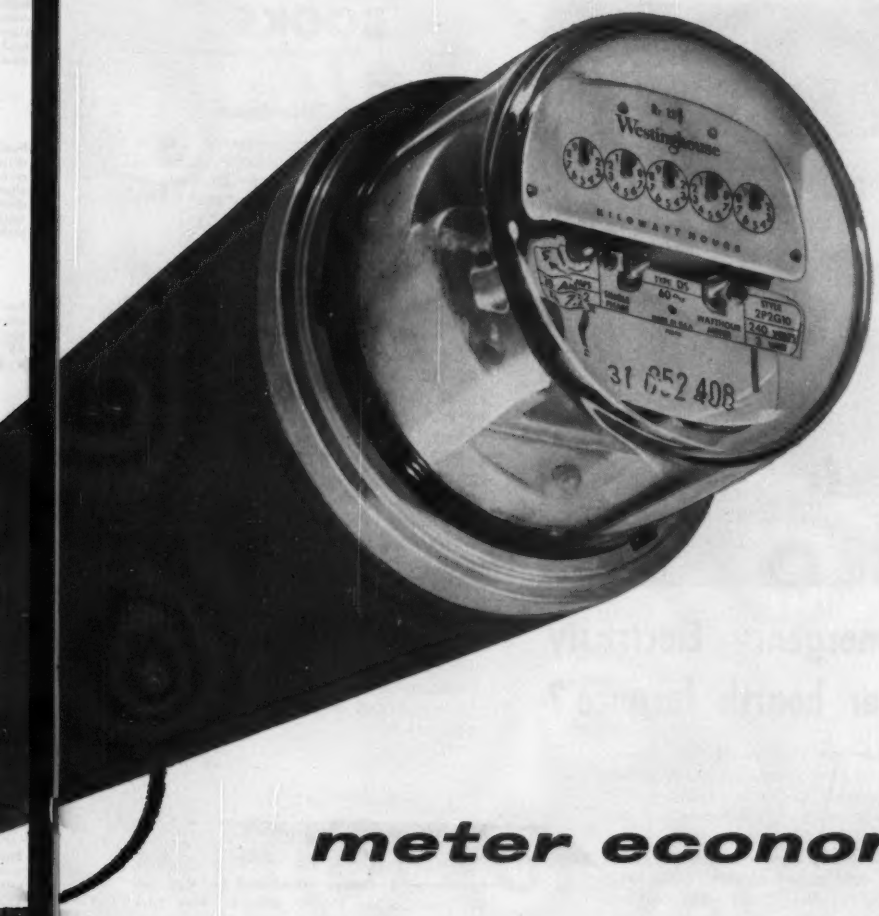
4100 WEST 150TH STREET
CLEVELAND 11, OHIO

OTHER PLANTS:
HOLAN Thrift Line CORP., Griffin, Georgia • J. H. HOLAN CORP., Phoenix Div., Arizona
BRANTFORD-HOLAN LIMITED, Brantford, Ontario

THE NAME THAT MEANS WORK SIMPLIFICATION

take a long look at...





meter economics

You can effect prompt and progressive savings by standardizing now on the *meter of the future* — the Westinghouse Lifetime 30-ampere, single-phase meter. With full 200-ampere extended range, it will measure all present and future single-phase residential loads that can be provided on single-phase service, and *it is guaranteed for 30 years.*

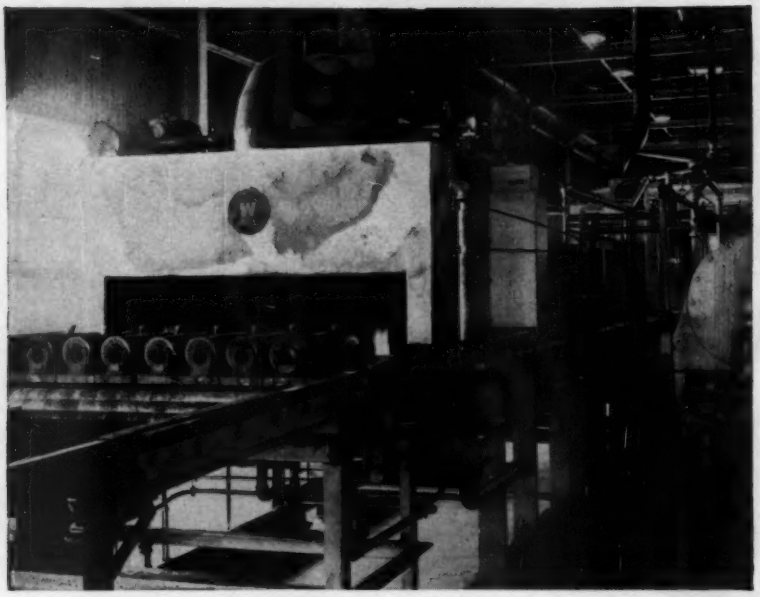
This year, 57% of the single-phase watthour meters purchased and installed by the Electric Utility Industry represented change-outs due to obsolescence in the face of growing load. The other 43% went on new homes with high initial loads and rapid growth potential.

This new 30-ampere Westinghouse meter certainly is the meter for this year — and '66 — and '76 — and even '86. First, consider the value of simplified inventory — if you standardized! Then take notice that there is *not one cent more investment,* initially, *than for modern 15-ampere ratings.* There's no mathematical trick. Call your Westinghouse sales office, or your Westinghouse meter specialist . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-40493

YOU CAN BE SURE...IF IT'S

Westinghouse

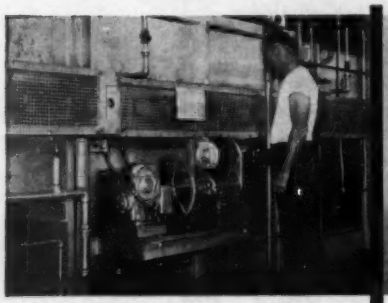


How does ONAN Emergency Electricity protect this electric roller hearth furnace?

This furnace operates at 1400° F. Inside are a series of steel rollers driven by an electric motor, which turn at low speed and move pallets loaded with metal parts through the furnace. If these rollers should stop turning for as short a period as 5 minutes . . . deformation will occur and the rollers must be replaced. This is a very costly repair.

To guard against this loss and to keep the furnace operating, the company installed an Onan 3,500-watt emergency electric plant with completely automatic controls. Now . . . if regular service is interrupted, the plant starts automatically and takes over the power load. It keeps the three ½ H.P. electric motors running and supplies 1,000 watts for emergency lighting.

Where an industrial process cannot be interrupted without serious loss . . . an Onan Emergency Electric Plant may pay its entire cost several times a year. Ask your consulting engineer, or electrical contractor about Onan Standby Power . . . or write us for information.



This is one of the electric motors on the emergency power circuit. Power is transmitted through the gear reducer in the foreground to drive furnace rollers at very low speed.

The Onan 3,500-watt emergency plant is installed in the plant 300 feet from the furnace. Automatic start and stop control is located near the furnace.

WRITE FOR FOLDER ON EMERGENCY POWER

Onan ELECTRIC PLANTS

D. W. ONAN & SONS INC.

2971 UNIVERSITY AVENUE S. E., MINNEAPOLIS 14, MINNESOTA

BOOKS

High Frequency Handbook

Taschenbuck der Hochfrequenztechnik. By H. Meinke and F. W. Gundlach. Published by Springer-Verlag, Reichpietschufer 20, Berlin W 35, Germany. 1,408 pages, illustrated. Price DM 69.

Most large German research and manufacturing organizations and 37 experts contributed charts, formulas, and data for this handbook of high frequency engineering. Its objective is to present the latest technical knowledge of electronic communication in a clear and reliable form. Included are wiring and wave guides, switching, condensers, antennas, vacuum tubes and transistors, amplifiers, transmitters, and receivers. A section is devoted to measurement techniques. But such related fields as electro-acoustics, television, radar, and medical equipment are omitted.

The book was planned as reference for high frequency engineers. This use is facilitated by a detailed table of contents and a 3,000-word index. But its value in the utility field will be limited to engineers whose duties include mobile radio and microwave design and application.

Electricity for Beginners

Industrial Electricity—Vol. I—Direct Currents. By Chester L. Dawes. Published by McGraw-Hill Book Co, Inc, 330 W. 42nd St., New York 36, N. Y. 431 pages with index, illustrated. Price, $5.50.

The third edition of this two volume text of electrical fundamentals is aimed more specifically at the technical institute level and includes a great deal of material normally found in a college engineering course. In revising Vol. I of the 1942 edition, the author has expanded discussions of fundamental theory, measurement systems, electric circuit theory, magnetic principles, and basic electrical machinery. Up-to-date treatments of the automatic motor starter, the amplidyne, the high voltage circuit breaker, the Varley loop, and the latest storage batteries have been added.

Intended to provide a broad knowledge of fundamentels for the beginner, the book is based on two engineering texts by the same author. Discussions are simple and straightforward and require no previous knowledge other than high school physics and algebra. The numerous diagrams and illustrations are well coordinated with the text. The book is organized with teaching methods in mind and includes 58 pages of questions and problems. This edition should be a valuable asset either for company training courses or for self study. Also as the title indicates, the material will be of value to industrial power salesmen.

Greater current-carrying capacity of Type AB butyl high-voltage cable helps users cut costs, use new or existing facilities more efficiently.

Cable that takes the squeeze out of crowded conduits

Now you can obtain the same amount of current with a smaller cable . . . or more current with the same size cable — with Anaconda's Type AB butyl high-voltage insulation.

For Anaconda Type AB butyl-insulated cable is recommended for operation at 90C operating temperature up to 5kv, and 85C at 5001 volts and up. Industry specifications recommend 70C for oil-base insulations. Thus, Type AB delivers more current-carrying capacity . . . more amps per dollar.

NEW ENGINEERING BULLETIN

Bulletin EB-27 gives you full details on performance on Type AB insulation in 15 Industry Specification Tests. Ask the Man from Anaconda for your copy. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

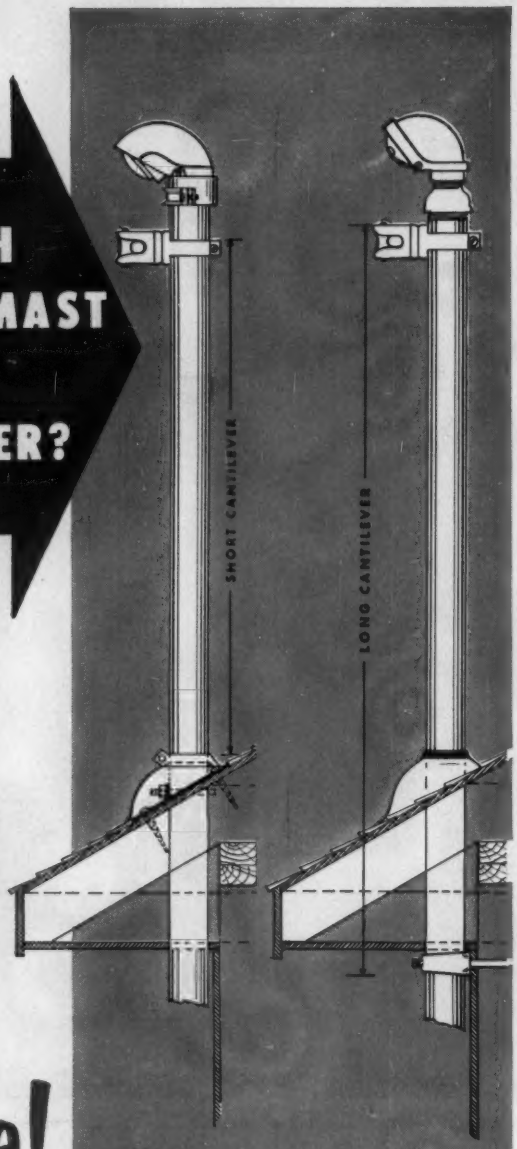
B-4256 Rev. (D)

NATIONAL ELECTRICAL Week FEB. 10-16, 1957

SEE THE MAN FROM **ANACONDA®**

—pioneer in **BUTYL INSULATION**

WHICH SERVICE MAST IS STRONGER?



Series 2075 Of Course!

SERIES 2075 MAST KIT

MAKE-SHIFT MAST

Porcelain Products service mast kits make possible strong, safe, trouble-free mast installations. The exclusive Roof Mounting Plate anchors the mast at the highest possible point (roof level) on the strongest possible framing (the rafters).

Porcelain Products Mast Kits are complete in every detail . . . eliminating sloppy, make-shift installations. For complete details . . . write today!

ELECTRICAL PORCELAIN SINCE 1894

62 years Porcelain Products, Inc. PP INC

FINDLAY, OHIO

SALES ASSIGNMENTS

COMPANY STAFFS

Hotpoint Co's commercial equipment department has as its new manager R. M. Ellis, former Cleveland district manager.

J. H. Holan Corp's new assistant sales manager at the main plant is Arthur C. Frank.

Miller Co has designated Dean J. Harryman as sales representative for the Illuminating Division in the Milwaukee area.

Minnesota Mining & Manufacturing Co's Richard T. Gustafson, formerly of Electrical Products Division, has been named sales manager of Ridgefield Division maintenance and construction trades.

Monsanto Chemical Co has promoted James J. Kelley to assistant district sales manager for the New York district.

Okonite Co has advanced Robert B. Zane to manager of district railroad sales for the Chicago office.

Philco Corp's Appliance Division has named Norman R. Millard as manager of sales to utilities.

Joseph T. Ryerson & Son, Inc, has designated Louis W. Werthman as sales manager for the San Francisco Bay area plant . . . Alfred J. Olson is new general sales manager for the firm's Chicago plant. The office of sales manager, vacated by Olson, has been assumed by Robert A. Daggit and Scott Vrooman.

Sprague Electric Co's Boston office has added James E. Flanagan to its sales staff.

Sylvania Electric Products, Inc, has appointed Richard G. Slauer as head of the Lighting Division's recently established sales organization for fluorescent lighting fixtures. As fixtures sales manager for lighting products, he will have reporting to him the following five area sales managers: C. J. Kelleher, northeast area, headquartered in Salem, Mass.; Paul P. Harrison, southeast area, Atlanta, Ga.; Robert L. Kuschwa, central area, Chicago; John G. Felton, southeast area, Dallas, Tex.; and Roger J. Delander, western area, San Francisco.

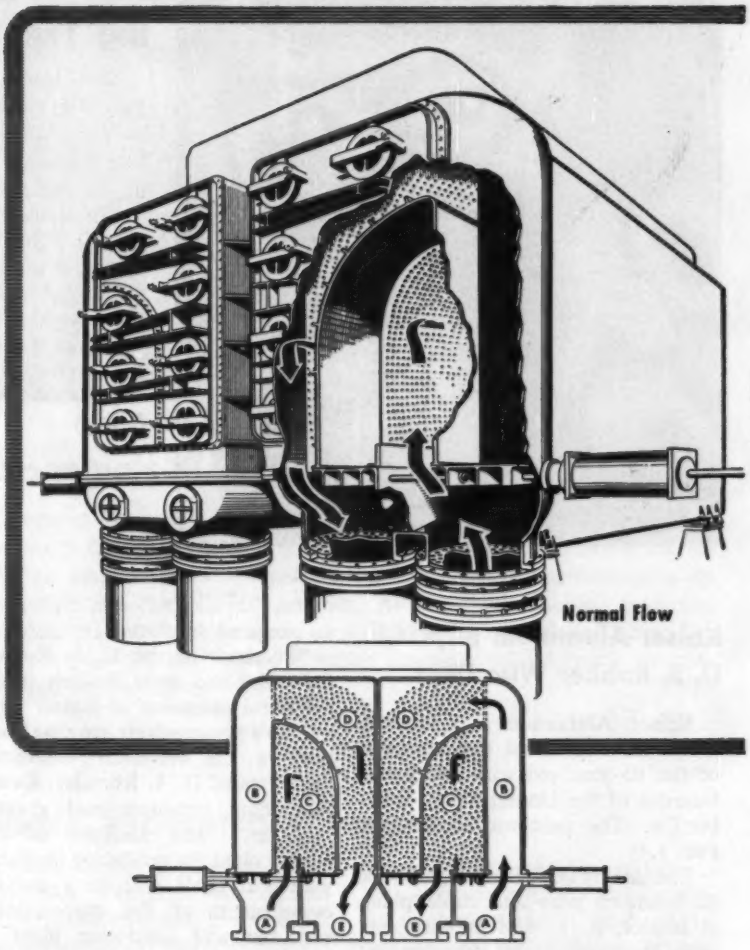
United States Steel Corp's American Steel & Wire Division has appointed William H. Guterl as assistant to the general manager of sales at the Cleveland, Ohio, headquarters . . . In a series of American Steel & Wire Division changes, William W. Deal has been named assistant to manager of sales, western area. His former post of manager of the Chicago district sales department has been assumed by Edward A. Murray. Charles P. Greenlee replaces Murray as manager of the Detroit district sales department, and William M. Welsh succeeds Greenlee as assistant manager of the Detroit district sales department.

REVERSE FLOW by C. H. WHEELER
Cleans Steam Condenser Tube Sheets Without Loss of Load

When debris and organic growth collect on the tube sheets of a C. H. Wheeler Patented Reverse Flow Steam Condenser, you don't have to shut it down for cleaning. It cleans itself—without loss of load. Sluice gates arranged within the condenser may be controlled, either electrically or hydraulically, to reverse the flow of cooling water through the tubes. This sudden reverse flow literally flushes away leaves and debris, dislodges crustaceous matter from clogged tubes.

Because of 100% water flow during back flushing, there is only a negligible dip in vacuum momentarily, thus permitting continuous load on the turbine The Reverse Flow Condenser cleans itself in minutes, compared with hours of downtime when tube sheets are manually cleaned. A typical report shows a half-inch loss of vacuum (due to fouled tubes and tube sheets) was restored in five minutes after reversing the flow of cooling water. Often, a C. H. Wheeler Reverse Flow Condenser goes two years or more without shut down for cleaning, depending on the condition of the cooling water.

New, exclusive deaerating features and construction techniques help make C. H. Wheeler Steam Condensers "First in Efficiency." Let C. H. Wheeler Custom Engineer your next steam condenser. Phone or write C. H. Wheeler Manufacturing Co., 19th & Lehigh, Philadelphia 32, Pa. . . . Manufacturers of Steam Power Plant Condensers • Vacuum Equipment • Marine Auxiliary Machinery • Water Supply, Drainage and Circulating Pumps.



HOW "REVERSE FLOW" WORKS

Left Side Shows Normal Operation

Water enters inlet A with right port open. Flows through tube bank C to rear of condenser . . . returns through tube bank D to front of condenser and discharges at E.

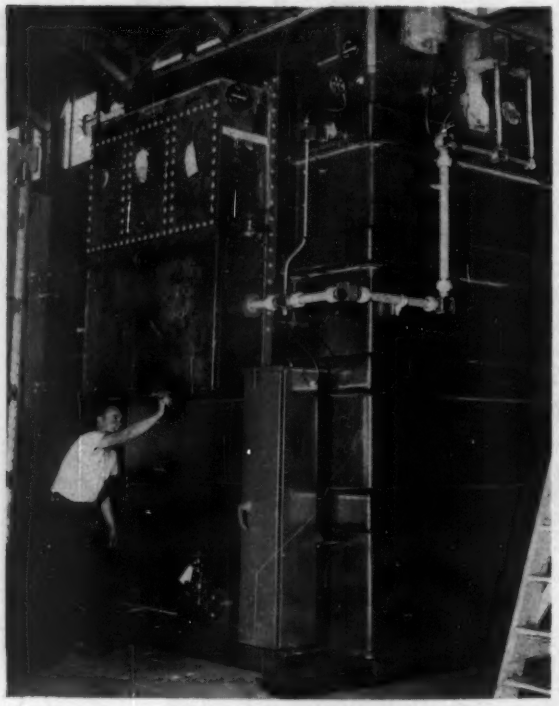
Right Side Shows Reverse Flow

Sluice gates move on a common stem. Water flows up through channel B, and through tube bank D to rear of condenser . . . returns through tube bank C to front of condenser.

In the C. H. Wheeler Divided Water Box Design, each half of the condenser can be back-flushed independently.

WE603

C.H. Wheeler OF PHILADELPHIA



Westinghouse Ships Big Transformer to SDG&E

This transformer, rated 10,000/12,500 kva and weighing more than 112,000 lb, is the largest ever built by Westinghouse at its Sunnydale, Calif., plant. The 5,577 gal of special oil required to cool it makes up for more than a third of its weight.

The transformer, one of two destined for San Diego Gas & Electric Co, will step down 67,000-v power from the utility's transmission system to voltages required for relay to substations or distribution centers.

A special feature of the big unit is that it automatically maintains a constant outgoing voltage. When assembled with cooling fins, bushings and lightning arresters, the transformer stands 19 ft high, 15 ft wide, and 13 ft deep.

Kaiser Aluminum Buys U. S. Rubber Wire Dept.

Kaiser Aluminum & Chemical Corp has announced the purchase of the 65-year old wire and cable business of the United States Rubber Co. The purchase is effective Feb. 1.

The sale by U. S. Rubber includes its insulated wire and cable plant at Bristol, R. I., and its wire and cable inventories, sales organization, and distribution network. Plans are to continue service without interruption to existing customers and maintain same channels of distribution.

"The 1,400 employees of the wire and cable department will be transferred to the Kaiser Aluminum organization," said H. E. Humphreys, Jr, chairman of U. S. Rubber. Pension, vacations, and various insurance benefits will be maintained, he remarked.

By acquisition of the Bristol plant, Kaiser Aluminum will immediately broaden its service to the electric industry by adding insulated conductors of different types, in both aluminum and copper, to its range of products.

"Purchase of the U. S. Rubber Co's wire and cable business forms a natural extension of Kaiser Aluminum's progressively growing position in the electrical conductor field," stated D. A. Rhoader, Kaiser Aluminum president and general manager. "The facilities of the Bristol plant for producing insulated wire and cable will be a natural complement to the corporation's rod, bar and conductor plant at Newark, Ohio."

IBM and UCLA Plan Data Processing Center

International Business Machines Corp and University of California at Los Angeles have established reportedly the world's first university computer center. It will be known as the Western Data Processing Center and located on UCLA campus.

UCLA reports the center will be used by business researchers and students from colleges and Universities in 11 western states and Hawaii. The project is planned as a major step toward solving the growing shortage of business analysts schooled in the use of electronic composers.

This center was made possible by a series of gifts from IBM. It includes a 705 electronic data processing machine which is housed in its own $75,000 research building.

S. M. Smith to Send Brazil Two 62,300-Hp Turbines

S. Morgan Smith Co of York, Pa, received an order for two 62,300 hp vertical Smith-Francis turbines to be installed in the Peixoto Hydroelectric Plant in the state of Minas Gerais, Brazil. Purchased by Ebasco International Corp for Cia Paulista de Forca E. Luz, the 125-in. turbines will operate at 138.5 rpm under a 154.8-ft head. The plant will be located on the Rio Grande River.

Shipment of the first embedded parts will begin in August, with final shipments on the second unit slated for completion in April, 1958. This installation is expected to be one of the largest in Brazil.

Conducting Silicone Rubber Developed by UCC

An electrical-conductive silicone rubber, now available commercially, is reported to be the first of a new class of silicone rubber compound. Known as X-1516, it is produced by Silicone Division of Union Carbide and Carbon Corp, New York.

This silicone rubber with a carbon-black fill is said to have electrical resistivities of less than 100 ohm-cm. By blending with other compounds, the electrical resistivity can be adjusted to a desired point within a certain range. It can be molded, calendered or extruded without appreciably changing its electrical properties.

Some applications of the silicone rubber compounds are: Electric heater for the home; electrically conductive shield for silicone insulated electrical equipment; industrial rolls provided with a means for dissipating static electricity, or heating the surface of the roll, or both; and tubing or hose to drain static charges and prevent sparking in handling explosive gases or dusts, or in hospital operating rooms.

Sangamo's New Pickens Plant Inspected

Sangamo Electric Co's. expansion program provides a new plant at Pickens, S. C., for increased production of power capacitors. When touring the new plant, visitors stopped to watch a personal demonstration by Sangamo's president, C. H. Lanphier. At one of the winding machines, Lanphier made a roll for capacitors as Bake Harris, Rumsey Electric Co, Philadelphia, left, and Don McKindley, Sangamo sales training director, observed the operation.

GE Makes 'Irrathene' and a Superstrong Magnet

An irradiated plastic has been moved from pilot research to full-scale production, and a superstrong magnet has been created by company researchers, according to recent announcements by General Electric Co.

Plastic: Irrathene irradiated polyethylene production is to be increased by 500%, announced Louis E. Newman, recently appointed general manager of GE's Insulating Materials Section. Newly constructed facilities at Pittsfield, Mass., will up production beginning this month from 300,000 lb to 1.6 million lb annually. And plans have been provided for a further doubling of that capacity.

The irradiated plastic is now being used to insulate power and telephone cables, switchgear, small electronic coils, large motors and generators. Its unique bonding and sealing qualities make it useful for coil encapsulation and wire harnessing.

Newman said insulating material engineers are currently developing a semi-conducting tape for power cables, an extrusion compound for wire coating and insulating, and a new grade of tape to withstand physical stress at temperatures higher than 350C.

Magnet: A potentially superstrong magnet made from invisible iron "dust" has been developed by researchers in two laboratories, announced Dr. T. O. Paine, manager of the Instrument Department's Measurement Laboratory at Lynn, Mass. Experimental magnets have been made equal to the strongest commercial magnets, he added.

E. E. Parker, Instrument Department general manager, declared the new magnet will result in electric instruments that are smaller, lighter, and more accurate and more rugged. It will be a while before the new magnets are commercially available.

This development, Parker remarked, opens new vistas to the design engineer because the iron particles can be embedded in plastics, metal, rubber or glass. The magnets are easily machined, drilled, tapped, soldered, and molded precisely into any desired shape.

Parker said that ordinary iron is used in the form of submicroscopic elongated particles to make the new magnet. A benefit is the saving of strategic metals like nickel and cobolt—used in making most magnets.

Richardson and Bear Become VP's of DP&L

R. B. Richardson has been elected vice president in charge of operations and Fred T. Bear has been named vice president of engineering of Delaware Power & Light Co.

Prior to his promotion Richardson served as assistant vice president in charge of operations. Shortly after graduation from Marietta College, he began his utility career as plant foreman for the Mobile Gas Co. He became manager of the Wilmington Gas Co in 1928, and when that company merged with DP&L he was named operating manager. He was later named assistant vice president-operations.

R. B. RICHARDSON

FRED T. BEAR

Bear, an electrical engineering graduate of Pennsylvania State College, entered the utility field in 1922 with Philadelphia Suburban Gas & Electric Co. Seven years later he joined DP&L as assistant electrical engineer. He then advanced to electrical engineer and manager of engineering. Bear served as assistant vice president prior to his recent election as vice president.

In other promotions, Harold W. Clift was named operating manager; and Charles W. Minich, manager of gas operations.

Bliss is Elevated

Lyman A. Bliss has been elected president of Union Carbide Nuclear Co, a Union Carbide & Carbon Corp division. Bliss, vice president of the division since 1955, replaces Kenneth Rush, a parent company vice president, who will continue his overall responsibility for the firm's nuclear and international activities.

B&W Ups Mackenzie

Newly elected vice president of Babcock & Wilcox Co is S. T. Mackenzie, formerly sales manager of the Boiler Division. A 22-year B & W veteran, Mackenzie will be in charge of the Boiler Division's sales department to assume the post that was vacated by the retirement of W. T. McCullough, Jr.

Three Executives Elected by Canadian Utility

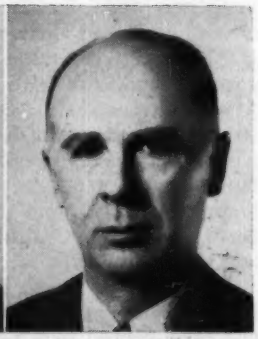
The board of directors of the Southern Canada Power Co, Ltd, has announced the election of George L. Rattee as executive vice president of the company.

The Montreal utility has also named E. A. Stanger to the position of vice president in charge of planning and D. A. Anderson as vice president in charge of plant.

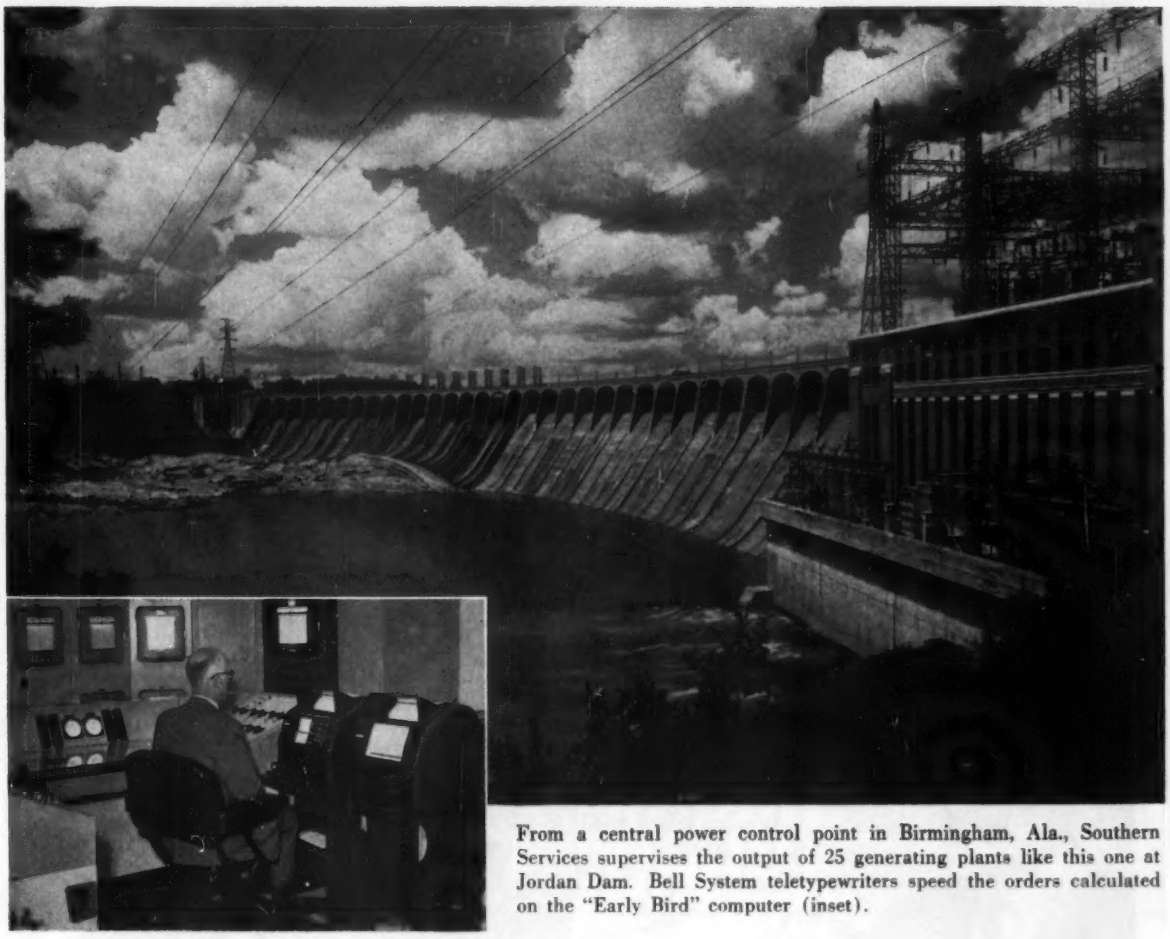
In addition to his post as executive vice president, Rattee was also elected to serve on the utility's board of directors.

GEORGE L. RATTEE

E. A. STANGER



D. A. ANDERSON



From a central power control point in Birmingham, Ala., Southern Services supervises the output of 25 generating plants like this one at Jordan Dam. Bell System teletypewriters speed the orders calculated on the "Early Bird" computer (inset).

How Bell System teletypewriter works with Southern's computer

Seated at the "Early Bird" computer in Birmingham, Ala., headquarters of Southern Services, Inc., the power co-ordinator transmits generating orders for 25 plants—by Bell System teletypewriter.

This close supervision contributes to more economical power supply to consumers in Alabama, Georgia, Mississippi, Florida. Power output, cost of power and transmission losses are figured continuously by the analogue computer. When load adjustments are necessary, Southern's co-ordinator sends the orders by private line teletypewriter.

Bell System service gives Southern speed, accuracy and dependability. And teletypewriter communications provide a day-to-day record of orders transmitted.

• • • •

Bell System private line service can make communications faster and more efficient for you. Call your Bell Telephone representative. He will be glad to study your needs.

BELL TELEPHONE SYSTEM

PRIVATE LINE TELEPHONE • PRIVATE LINE TELETYPEWRITER

CHANNELS FOR: DATA TRANSMISSION • TELEMETERING • REMOTE CONTROL • TELEPHOTOGRAPH • CLOSED CIRCUIT TV

Burndy Corp Promotes Three Top Officers

The Burndy Corp of Norwalk, Conn., has promoted Sidney Wolberg to vice president, purchasing; Stanley M. Loomis vice president, finance; and George M. Szabad vice president and counsel.

A 30-year veteran with Burndy, Wolberg previously had been director of purchases. He joined the firm just after graduation from New York University and was elected secretary in 1939, a post he continues to hold along with his new duties.

Loomis joined Burndy in 1949 as controller and was made treasurer in 1955. He will continue to serve as treasurer as well as serve in his new capacity.

SIDNEY WOLBERG STANLEY M. LOOMIS GEORGE M. SZABAD

Szabad, an attorney and member of Blum, Jolles, Gruber, Szabad & Gerson, general counsel for Burndy, started with the corporation in 1954 as legal counsel. As an officer of the firm, Szabad is in charge of legal matters, stockholder and various financial matters.

E. WARREN BOWDEN

Walter Kidde Advances Bowden

E. Warren Bowden has been elected executive vice president of Walter Kidde Constructors, Inc. Formerly a vice president, Bowden will continue to serve as a director of the firm and vice president and director of Walter Kidde Engineers-Southwest, Inc.

Bowden joined Kidde in 1943 as assistant to the president and previous to that he was assistant to the chief engineer of the Port of New York Authority.

PERSONAL BRIEFS

C. L. Stephenson, Jr, assistant secretary and formerly administrative assistant in the executive department of Mississippi Power & Light Co, has been transferred to the operating department as operating assistant. **Carr Black,** formerly stores supervisor, has been named director of stores and purchasing. **Frank S. York, Jr,** has been elected assistant secretary of the firm. . . . Pacific Gas & Electric Co has named **Stanley B. Barton** as manager of its land department, succeeding **B. K. Dunshee,** who has retired.

James A. Dildy has been appointed area and industrial director of the Arkansas Power & Light Co, succeeding **W. H. Kennedy, Jr,** who resigned recently.

William Carter, district sales manager of Anaconda Wire & Cable Co, has been elected president of the Electric Association of Kansas City.

Kenneth G. Ellsworth has been appointed director of public relations of American Standards Association.

C Lyn Fox, political editor of the San Francisco Call-Bulletin, has been appointed commissioner of California Public Utilities Commission, succeeding **Justus F. Craemer,** retired.

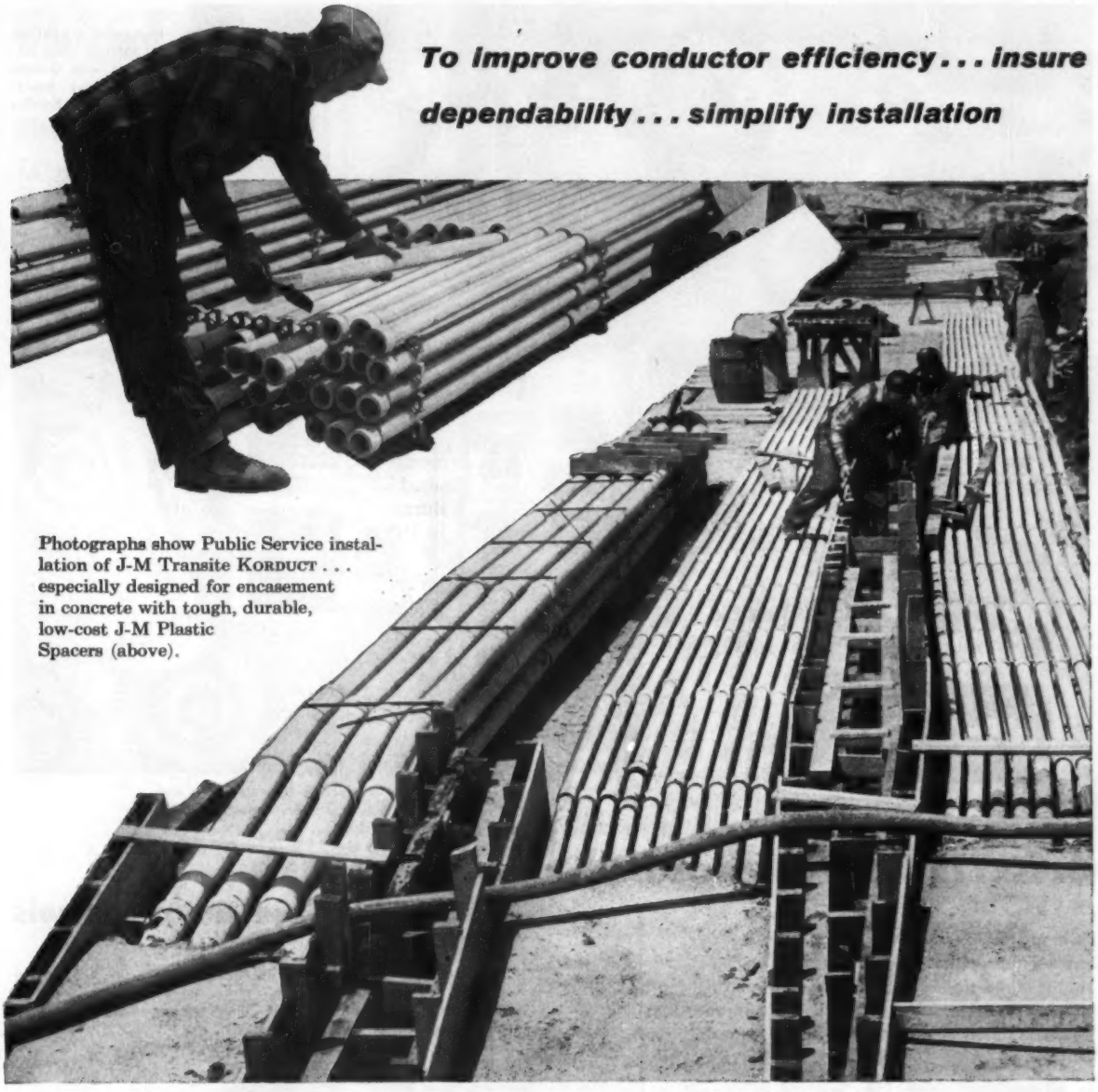
S. M. Cameron, vice president of Howard P. Foley Co, has been elected president of the Electrical Association of Philadelphia.

Ohio Brass Co has appointed **P. M. Ross** to head their newly formed Equipment Division and **Gene Shoemaker** will head the also newly formed Transmission and Distribution Division. These new divisions are being incorporated into the company's Power Utilities Department. Replacing Shoemaker as manager of the foreign trade department is **Brad Johnson.**

Promotion of **W. R. McCauley, Jr,** to deputy assistant manager for administration has been announced by **S. R. Sapirie,** manager of the AEC's Oak Ridge Operations.

Fluor Corp, Ltd, has elected **James D. Harris** vice president and general counsel.

To improve conductor efficiency . . . insure dependability . . . simplify installation



Photographs show Public Service installation of J-M Transite KORDUCT . . . especially designed for encasement in concrete with tough, durable, low-cost J-M Plastic Spacers (above).

Public Service of New Jersey chooses Transite asbestos-cement Ducts

Economical Transite Ducts are part of Public Service Electric and Gas Company of New Jersey's plan for top operational efficiency at the new Linden Generating Station. With Transite Ducts on power circuits, current-carrying capacities are higher . . . copper losses lower . . . because Transite dissipates heat faster than organic ducts.

Johns-Manville Transite Ducts protect control circuits permanently. Transite will never rot, rust or corrode, is incombustible and non-inductive, because it is made of asbestos and cement.

Transite is easy to install . . . light, 10-foot lengths require fewer joints . . . direction changes are easy with the wide variety of Standard Transite fittings. And the unusually smooth bore permits easy cable pull-through and prevents injury to cable sheath.

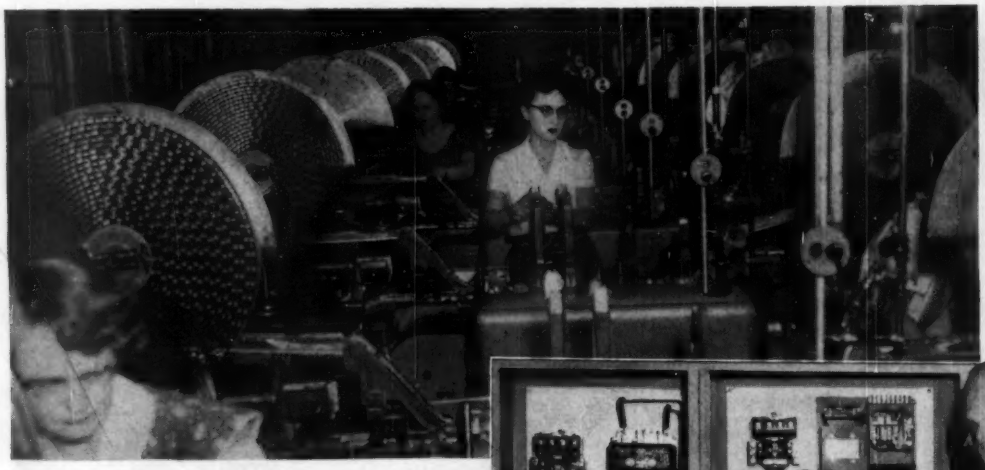
• • •

For complete information on Transite Ducts, write to Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

Johns-Manville TRANSITE® DUCTS

CONDUIT for exposed work and installation underground without concrete encasement

KORDUCT® for installation in concrete



Packaging machines for loading small dispensers with Gillette razor blades equipped with Allen-Bradley motor controls.

The Sign of
QUALITY
Motor Control

Gillette
RAZORS & BLADES

Installation of Allen-Bradley solenoid relays and starters on a typical Gillette production job.

GILLETTE BLADE PRODUCTION MAINTAINED with A-B Trouble Free Motor Controls

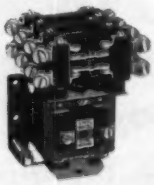
Both machinery buyers and machinery builders are familiar with the A-B trademark and know that it is the sign of QUALITY motor control. It guarantees continuous and reliable operation under the most severe operating conditions.

Allen-Bradley control engineers are located in all principal cities. They will gladly consult with you about your motor control problems.

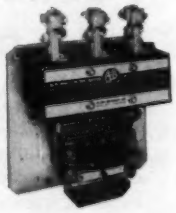
Allen-Bradley Co., 1327 S. First St., Milwaukee 4, Wis.
In Canada—Allen-Bradley Canada Ltd., Galt, Ont.

Bulletin 712 combination starters combine manual disconnect and automatic starter in one enclosure. Cabinet cannot be opened unless the disconnect lever is in the "off" position.

To maintain production of quality razor blades by the millions, precision machinery and reliable controls are a necessity. Therefore, it is considered significant that Gillette uses Allen-Bradley solenoid relays and starters for this purpose.



Gillette special-purpose control panels are equipped with Allen-Bradley relays, contactors, and starters. Again, the simple one moving part design has demonstrated its superiority—it provides the assurance of millions of trouble free operations. Incidentally, the double break, silver alloy contacts used throughout the line need no service attention—they are always in good operating condition.



ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

ELECTRICAL BUSINESS OUTLOOK

Electrical World
JANUARY 21, 1957

Consumers won't add quite the bounce to durable sales that they did in '55. (That was the year they triggered a boom through purchases of autos, appliances, and other big durables.) This is gist of the latest study of consumer intentions by Survey Research Center of University of Michigan. Conclusions are based on a nationwide survey run between mid-November and mid-December.

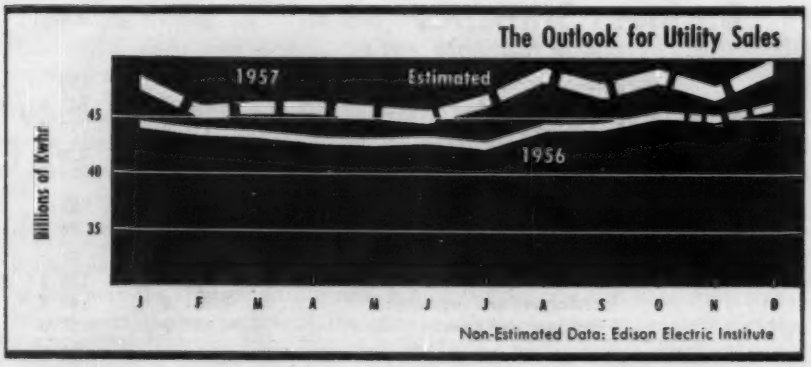
This doesn't necessarily conflict with more optimistic outlooks voiced by manufacturers (EW, Dec. 31, p 9) or dealers. The university's survey can't, of course, measure things like impulse buying or postponement of soft goods purchases for durables. Even if durable sales lack expected zip, it will probably not be a serious drag on the economy. Food and clothing purchases will continue to rise. So will services. This means total consumer spending will go up even if over-all durable sales stabilize.

The stand-offish mood consumers displayed last year in buying some major appliances—refrigerators, TV, washing machines, and freezers—still applies, according to the survey. However, there does appear to be slightly more bouyancy in buying plans of upper-income families.

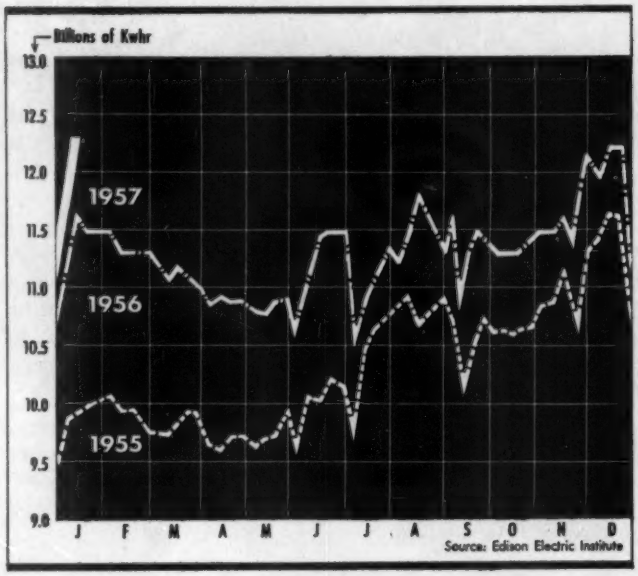
The survey showed some increase in intentions to buy autos, but nothing like that found in 1955. Plans to buy second-hand cars are up sharply. More people desire to buy a house now than last year. But tight credit could force a lot of hopeful home buyers to postpone plans.

The survey suggests two explanations for the cautious mood: 1. Consumers see fewer "good buys" around. They began to feel rising prices in 1955. And it is study group's belief that rising prices discourage big purchases. **2.** More consumers have a feeling their incomes are leveling off. They feel well off and confident of the economy. But they do not expect the income lift that is apt to touch off purchases of big durables.

Many economists have expected durable sales to boom this year, particularly autos. Several factors have pointed to it. The consumer is on a rising tide of income. Personal income rose by $16 billion (after taxes) last year. And employment through 1957 is expected to rise. That will mean even higher incomes. Also, "savings," either real or through repayment of installment loans, mounted last year. This should put consumers in a favorable position to take on new installment commitments. But the survey results indicate that they may not plan it that way.



STATISTICS



OUTPUT

Week ended Jan. 12, 12,327,000,000 Kwhr Up 6.3%

Per Cent Change From Previous Year

	Dec. 29	Jan. 5	Jan. 12
Total U. S.	+4.1	+5.6	+ 6.3
New Eng.	+2.3	+3.9	+ 4.6
Mid Atlantic	+0.9	+2.7	+ 3.3
Cent. Ind.	+3.9	+4.8	+ 6.3
West Cent.	+6.0	+7.3	+10.3
Southeast	+2.7	+5.0	+ 2.9
South Cent.	+9.4	+9.6	+12.1
Rocky Mount.	+9.5	+9.4	+11.0
Pacific			
NW	+6.6	+6.4	+ 9.9
SW	+6.6	+9.9	+11.2

Seasonally Adjusted Index 225.8
Week Ago 224.9
Year Ago 212.4

Atomic Energy Commission requirements—1,150,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 6.8%

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Oct.	119.38	118.66	112.13	6.5
Peak—Class 1 Systems (million kw)	Oct.	96.6	96.5	90.7	6.5
Estimated Dec. '56 Peak (million kw)	Oct.	106.20	106.17	104.34	1.8
Production—billion kwhr	Oct.	51.13	48.82	47.70	7.9
Hydro		9.24	8.96	8.80	4.9
Fuel		41.89	39.86	38.60	8.5
Sales—billion kwhr	Oct.	45.98	46.07	43.06	6.8
Residential		11.27	11.68	10.38	8.6
Commercial		7.37	7.82	6.88	7.1
Industrial		24.79	23.86	23.34	6.2
Other		2.56	2.72	2.45	4.5
Fuel Consumption	Oct.				
Coal—million tons		13.52	12.45	12.65	6.9
Oil—million barrels		6.27	5.20	6.04	3.8
Gas—million cu ft		114.36	124.63	104.80	9.1
Net Income Class A & B Co's—$ million	Oct.	95.79	108.45	94.61	1.2
Residential Customers—millions	12 mos.	45.49	45.39	44.21	2.9
Revenue per kwhr	ended	2.60¢	2.61¢	2.65¢	−1.9
Avg kwhr per customer	Oct. 31	2,942	2,929	2,715	8.4
Avg annual bill		$76.49	$76.45	$71.95	6.3

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Nov.	149	150	144	3.5
ENR Construction Cost	Jan.	148.4	147.6	141.8	4.7
BLS Cost-of-living	Nov.	117.8	117.7	115.0	2.4
New Orders for Machinery (1950 = 100)	Nov.	140	139	143	−2.1
NEMA Sales					
Insulation materials	Nov.	149	163	155	−3.9
Electric appliances		81	94	88	−8.0
Wholesale prices	Oct.				
Motors and generators		136.9	136.2	125.3	9.3
Transformers and regulators		144.8	144.8	129.2	12.1
Switchgear and fuses		161.9	157.0	146.3	10.7
GNP—annual rate—$ billion	3rd Qtr.	413.8	408.3	396.8	4.3

MANAGEMENT BULLETIN

FINANCE

Despite the shortage of capital funds, new securities of electric utilities put on the market during the week of Jan. 7 were grabbed up by the investing public. Last week saw another heavy offering of securities. White, Weld & Co, Blyth & Co, and Shields group won $20 million Louisiana Power & Light Co first mtge 4¾% bonds (A) due in 1987 with a bid of 100.1599%; reoffered at 101.25% to yield 4.67%. Issue is reported "moving along." Missouri Public Service Co is offering 319,894 common shares to its stockholders on a 1-for-5 basis, record Jan. 15 to expire Jan. 29 at $13 a share. The deal to exchange the 409,500 common shares of Lynn Gas & Electric Co for 819,000 common shares of New England Electric System has been postponed until around Feb. 1. As EW went to press, Oklahoma Gas & Electric Co was waiting for bids on $20 million first mortgage bonds (Aa) due in 1987.

Montana Power Co common stock is being offered for the third time to employees of the company on an installment payment plan. In the first two offerings, about 20,000 shares with a market value in excess of $500,000 were bought by employees. In making the third offering, Montana Power's Pres J. E. Corette said that more than half of the employees now own stock.

After receiving New York PSC approval for a negotiated rather than a competitive deal (EW, Jan. 7, p 109), Harriman Ripley & Co group is underwriting an offering of $46,224,200 convertible 4⅝% debentures due 1972 of Niagara Mohawk Power Corp. Debentures are priced at $100. Rights, expiring on Jan. 28, are on the basis of a $100 debenture for each 25 shares of common stock owned of record Jan. 10. Debentures are convertible into common at $31.75 a share.

Consumers Power Co is planning to buy the St. Louis, Mich., Municipal Power Plant including the distribution system for $478,000 . . . Ohio Edison Co has completed purchase of Leroy, Ohio, Municipal Light Department facilities for $78,500.

Common stock dividends continue upwards. Rockland Light & Power Co will pay 20¢ a share quarterly as compared with 17½¢ previously . . . Long Island Light Co's dividend has been hiked to 30¢ versus 27½¢ in the previous quarter.

A total of 23 electric and gas public utility holding company systems were registered with the Securities and Exchange Commission at June 30, 1956. These controlled 4 subholding companies, 164 electric and gas utilities, and 111 non-utility companies. At Dec. 31, 1955 the aggregate assets of these systems, less valuation reserves, totaled $10.4 billion. During the year holding company system company securities approved by SEC under the Public Utility Holding Co Act of 1935 for sale to the public and institutional investors amounted to $565 million.

LABOR

Engineering students are on the increase. University of Wisconsin has reported that 38.8% of its men students are now enrolled in engineering courses. This compares with 35.4% in 1955 and 25.9% in 1952.

A booklet entitled "Apprentice Training—An Investment in Manpower," has been released by U. S. Department of Labor's Bureau of Apprenticeship. It explains in non-technical language the aims, organization, and operation of the national apprenticeship program. For copy, write Publications Branch, Bureau of Apprenticeship, U. S. Department of Labor, Washington 25, D. C.

Columbia University has scheduled two sessions during the summer of 1957 in its Executive Program in Business Administration. Each is a six-week course for top management personnel, designed to strengthen each participating executive's concepts of planning and decision-making and to help him develop his

abilities in administrative processes. Classes are limited to 55 senior-level executives. First class runs from June 16 to July 27; other from Aug. 11 to Sept. 21. For further information contact John Hastings, Columbia University, New York 27, N. Y.

REGULATION

National Association of Railroad and Utilities Commissioners' Uniform System of Accounts for electric, gas, and water utilities (three separate books) are now available. For copies, write State Law Reporting Co, 30 Vesey St., New York 7. Cost: $5 for each book.

Milan, Tenn., Department of Public Utilities has reduced electric rates by about $45,000 a year for its 4,400 consumers. It became effective Jan. 7.

AREA DEVELOPMENT

Saturday Evening Post has published a booklet containing 169 ECAP ads (Electric Companies Advertising Program) which have been carried in the magazine for the last 15 years. The magazine said that 15 years ago more people favored federal public power. Today the balance has swung in favor of the electric companies. Write Ed Dunning, vp, N. W. Ayers & Son, 30 Rockefeller Plaza, New York 20, N. Y. for a copy.

YOUR HEALTH

Constipation:

REX H. WILSON, MD, Medical Director, B. F. Goodrich Co

There is no law of nature that says you must have a bowel movement every day. The normal frequency of evacuation varies from 1, 2 or 3 movements a day to 1 movement every 3 or 4 days.

While some cases of constipation are due to organic obstructions, most are purely functional in origin. Nearly everyone suffers from periods of constipation. Some people are always constipated.

There are many causes of constipation. The bowels may lack proper muscle tone or they may be in spasm due to irritation. They may lose their power to function normally due to the over-use of cathartics. Nervous tension, a change in diet, and even travelling can cause a change in the habit pattern of our bowel movements.

Rectal conditions like hemorrhoids can cause a rectal spasm and keep the fecal mass from being evacuated. Diseases of the bowel and related organs can be a cause. Improper diet, insufficient fluid intake and high pressure living are factors. Perhaps the most common cause is a persistent disregard of the call of nature.

Most persons are over-impressed with the necessity of having a daily bowel movement. When the bowel fails to move, a fear of being poisoned by the retained fecal material develops. The symptoms of prolonged constipation are headaches, loss of appetite, difficulty in breathing, coated tongue, dizziness, fatigue and lack of mental concentration. There may be sensations of fullness or pressure in the rectum and lower abdomen. Sometimes coils of spastic bowel or actual fecal masses can be felt. The fecal material is usually hard, but may be of normal consistency.

Chronic constipation reduces physical and mental tone and increases the likelihood of fatigue and infection. Inflammation of the bowel, diverticula, fissures and hemorrhoids may result.

Persons who suddenly become constipated may have some organic disease that interferes with the function of the bowel. Such cases require study.

Most cases of constipation can be relieved by acquiring proper bowel habits. They must learn to go to the toilet at a regular time daily. A change in diet may be needed. The bulk of feces is derived from fruit, vegetables and coarse cereals. Preparations containing bulk such as agar-agar and mineral oil, mucilose, and psyllium seed, will help.

Oil retention enemas may act as a stimulation. Mild laxatives may be required as a last resort. Enemas may be indicated in acute cases. Manual removal of the impacted fecal mass from the rectum may be necessary.

There is no need for worry if you do not have a bowel movement every day. After all, the bowel is not a water closet which must be flushed daily.

A Record Unmatched In The Industry . . .

In *Every One* of the Nation's "Top Six"* Steam Power Plants, Fly Ash Control is by *Western Precipitation!*

As most power plant executives know, the Federal Power Commission annually "rates" the major steam power plants of the United States to determine their overall thermal efficiency as represented by their heat rate (i.e., BTU of fuel consumed per KWH of generated power).

*The "Top Six" steam plants according to the most recent Federal Power Report are . . . 1. Kyger Creek Plant (Ohio Valley Electric) . . . 2. Clifty Creek Plant (Indiana-Kentucky Electric) . . . 3. Kanawha River Plant (Appalachian Electric Power) . . . 4. St. Clair Plant (Detroit Edison) . . . 5. Muskingum River Plant (Ohio Power) . . . and 6. Tanners Creek Plant (Indiana and Michigan Electric).

We at Western Precipitation Corporation, take great pride in the fact that—in EVERY ONE of these "Top Six" plants—the equipment selected for fly ash control is WESTERN PRECIPITATION equipment.

Could there be any greater testimony to the outstanding superiority and unsurpassed efficiency of Western Precipitation fly ash control equipment?

COTTRELL Electrical Precipitators
MULTICLONE Mechanical Collectors
CMP Combination Units
DUALAIRE Reverse-Jet Filters
HOLO-FLITE Processors

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Precipitation Company of Canada Ltd., Dominion Square Building, Montreal

Representatives in all principal cities

MEETINGS CALENDAR

JANUARY

Atomic Industrial Forum, Inc—Forum Insurance Meeting, Plaza Hotel, New York, N. Y., Jan. 21-22.

American Institute of Electrical Engineers—Winter General Meeting, Hotel Statler, New York, Jan. 21-25.

Pennsylvania Electric Association—Prime Movers Committee, Roosevelt Hotel, Pittsburgh, Pa., Jan. 24-25; Transmission & Distribution Committee, Penn Harris Hotel, Harrisburg, Pa., Jan. 31-Feb.1; Hydraulic Power Committee, Brunswick Hotel, Lancaster, Pa., Jan. 31-Feb. 1.

Southwest American Power Dispatchers Association—Winter Meeting, Phoenix, Ariz., Jan. 26.

Canadian Electrical Association—Eastern Zone Meetings, Quebec, Canada, Jan. 28-31.

American Welding Society—3rd Annual Midwest Welding Conference, Illinois Tech Chemistry Bldg., Chicago, Ill., Jan. 30-31.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, Hotel President, Kansas City, Mo., Jan. 31-Feb. 1.

• **Edwin L. Weigand Co**—Electric Heating Workshop, Pittsburgh, Pa., Jan. 31-Feb. 1.

FEBRUARY

Ninth Annual Industrial Engineering Institute—University of California, simultaneous sessions in Berkeley and Los Angeles, Calif., Feb. 1-2.

National Association of Purchasing Agents—26th Annual Mid-Winter Conference, Public Utility Buyers' Group, Brown Hotel, Louisville, Ky., February 3-5.

Edison Electric Institute—Prime Movers Committee, Deschler Hilton Hotel, Columbus, Ohio, Feb. 4-6; Electrical Space Heating and Air Conditioning Committee, St. Louis, Mo., Feb. 6-8; Transmission & Distribution Committee, Netherland Plaza Hotel, Cincinnati, Ohio, Feb. 7-8; Electrical System & Equipment Committee, Somerset Hotel, Boston, Mass., Feb. 11-12; Residential Lighting Committee, Cincinnati, Ohio, Feb. 11-13; Commercial Cooking & Water Heating Committee, Tutwiler Hotel, Birmingham, Alabama, Feb. 14-15; Residential Promotion Committee, New York, N. Y., Feb. 14-15.

American Society for Testing Materials—Annual Committee Week and Spring Meeting, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 4-8.

Pennsylvania Electric Association—Electrical Equipment Committee, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 7-8; Communications Committee, Hotel Americus, Allentown, Pa., Feb. 11-12; System Planning Committee and Systems Operation Committee, Benjamin Franklin Hotel, Feb. 14-15; Relay Committee, Roosevelt Hotel, Pittsburgh, Pa., Feb. 28-Mar. 1.

National Electrical Week—Second Annual Observance, Feb. 10-16.

Electric Institute of Washington—Electrical Trade Conference and Exposition, Shoreham Hotel, Washington, D. C., Feb. 12-14.

National Electrical Manufacturers Association—General Purpose Control Subcommittee, Advisory Committee, Industrial Control Section and Industry Control Subcommittee, Advisory Committee, Industrial Control Section, Feb. 13; Electronic Control Subcommittee, Advisory Committee, Industrial Control Section and Standards Committee, Advisory Committee, Industrial Control Section, Feb. 14—all being held at NEMA Headquarters, 155 East 44th St., New York, N. Y.

American Institute of Electrical Engineers—1957 Transistor & Solid State Circuits Conference, sponsored jointly with Institute of Radio Engineers and University of Pennsylvania, Philadelphia, Pa., Feb. 14-15.

• **American Public Power Association**—First Engineering and Operations Workshop, Springfield, Mo., Feb. 14-15.

National Society of Professional Engineers—Spring Meeting, Hotel Francis Marion, Charleston, S. C., Feb. 15-16.

• **Cleveland Electronics Conference**—Masonic Auditorium, Cleveland, Ohio, Feb. 15-16.

National Adequate Wiring Conference—13th Annual Discussion, Sherman Hotel, Chicago, Ill., Feb. 21-22.

North Central Electrical League—20th Annual Upper Midwest Electrical Industry Convention, Leamington Hotel, Minneapolis, Minn., Feb. 24-27.

American Society of Heating and Air-Conditioning Engineers—63rd Annual Meeting, Chicago, Ill., Feb. 25-28; 13th International Heating and Air-Conditioning Exposition, Chicago, Ill., Feb. 25-Mar. 1.

Institute of Radio Engineers—Western Joint Computer Conference, Hotel Statler, Los Angeles, Calif., Feb. 26-28.

Electrical Equipment Representatives Association—Annual Meeting, St. Anthony Hotel, San Antonio, Tex., Feb. 27-Mar. 2.

Pacific Coast Electrical Association—Business Development Section, Sheraton-Palace Hotel, San Francisco, Calif., Feb. 28-Mar. 1.

MARCH

Southern Safety Conference—John Marshall Hotel, Richmond, Va., Mar. 3-5.

Louisiana State University—Annual Conference on High-Speed Computers, Baton Rouge, La., Mar. 5-8.

Engineers Joint Council—2nd Nuclear Engineering and Science Conference; 3rd International Atomic Exposition, and 5th Hot Laboratories and Equipment Conference, Convention Hall, Philadelphia, Pa., Mar. 11-15.

• **Electric Companies Public Information Program**—Inter-Regional Committee, New York, Mar. 12; Steering Committee, New York, Mar. 14.

National Electrical Manufacturing Association—General Engineering Committee, Switch and Enclosed Breaker Section, Chase Hotel, St. Louis, Mo., Mar. 13; Panelboard and Distribution Board Section, Molded Case Breaker Section and Busway Section, Chase Hotel, St. Louis, Mo., Mar. 14.

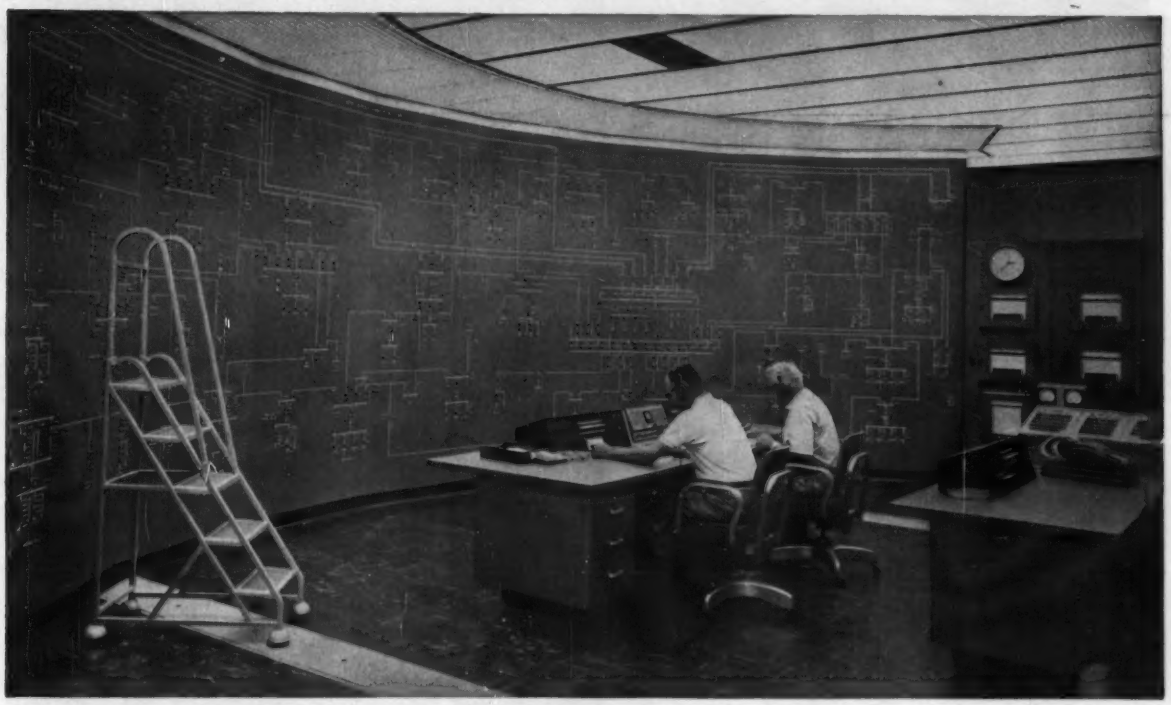
Northwest Electric Light & Power Association—Business Development Section, Empress Hotel, Victoria, B. C., Mar. 18-20.

Institute of Radio Engineers—Annual National Convention and Radio Engineering Show, Waldorf-Astoria Hotel and New York Coliseum, Mar. 18-21.

• **American Society of Mechanical Engineers**—Gas Turbine Conference, Sheraton-Cadillac Hotel, Detroit, Mich., Mar. 18-21; Engineering Management Conference, William Penn Hotel, Pittsburgh, Pa., Mar. 27-28.

Edison Electric Institute—Industrial Relations Committee, EEI Headquarters, New York City, Mar. 21.

• Additions this week.



New Jersey Power and Light Reports

GENERAL ELECTRIC PROGRESS LINE TWO-WAY RADIO PROVIDES MAXIMUM COVERAGE

New Progress Line Units Are Assigned Exclusively to Long-range Duty

After replacing many of its 100 mobile radio units with new General Electric Progress Line units, New Jersey Power & Light Company learned that the new G-E units perform so well that they are now assigned to the trucks that operate farthest from their base stations.

Get Greater Range and Better Reception

In addition to the excellent range of operation provided by the new General Electric units, Harold Mann, communications engineer, is enthusiastic about the high-fidelity quality of messages from mobile units. This, he explained, is due largely to the controlled reluctance microphones supplied with all Progress Line mobile units.

The utility's radio system includes 10 base stations throughout the northern half of New Jersey, 5 of which have 450-mc repeaters, and 100 low band 60-watt mobile units.

Maintenance of all New Jersey Power & Light Co. radio equipment is provided by the Warner Engineering Company, an authorized General Electric Service Station located in Upper Montclair, N. J.

The utility reports that its 10-year experience with radio has proven a maintenance contract with the General Electric Service Station is more economical than providing service through its own maintenance department, and is equally effective.

For Sales and Service...see "Radio Communication Equipment" in your yellow pages. Or, write: General Electric Company, Communication Equipment, Section C2217-21, Electronics Park, Syracuse, New York. *In Canada:* C.G.E. Electronics, 181 Lansdowne Avenue, Toronto.

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You'll find help—*fast*—both on standard and special requirements, from PLM. Hundreds of stock sizes and ratings of terminating fittings through 15 kv, and splicing and terminating kits through 23 kv, are listed in PLM Catalog 301. Special adaptations can be supplied on short shipping schedules. Put your problems up to PLM today . . . write for catalog or quotations on your needs.

PLM PRODUCTS, INC. • 3873 West 150th Street • Cleveland 11, Ohio
WIRE AND CABLE FITTINGS AND ACCESSORIES

Redondo Control

(Continued from page 65)

Conversion to centralized control over a little longer than a year was completed without hampering normal station operation. To reduce outage time on centralized control equipment, advantage was taken of planned outages to complete as much work as possible before actual cutover. Boiler connections were scheduled during routine maintenance. After control connections were made on each boiler, its operation was resumed as before until the conversion work on all equipment was completed.

Connection of transmitters for instrumentation generally involved only a short outage of the local instruments. To expedite work and avoid confusion and noise in the control room, the control boards were pre-assembled by the manufacturer. An effort was made to shield the operating area of the control room at all times from construction activities. A substantial temporary, soundproof, floor-to-ceiling wall was erected between the new addition and the area of station electrical control, and a heavy curtain was hung to protect the turbine room from construction debris.

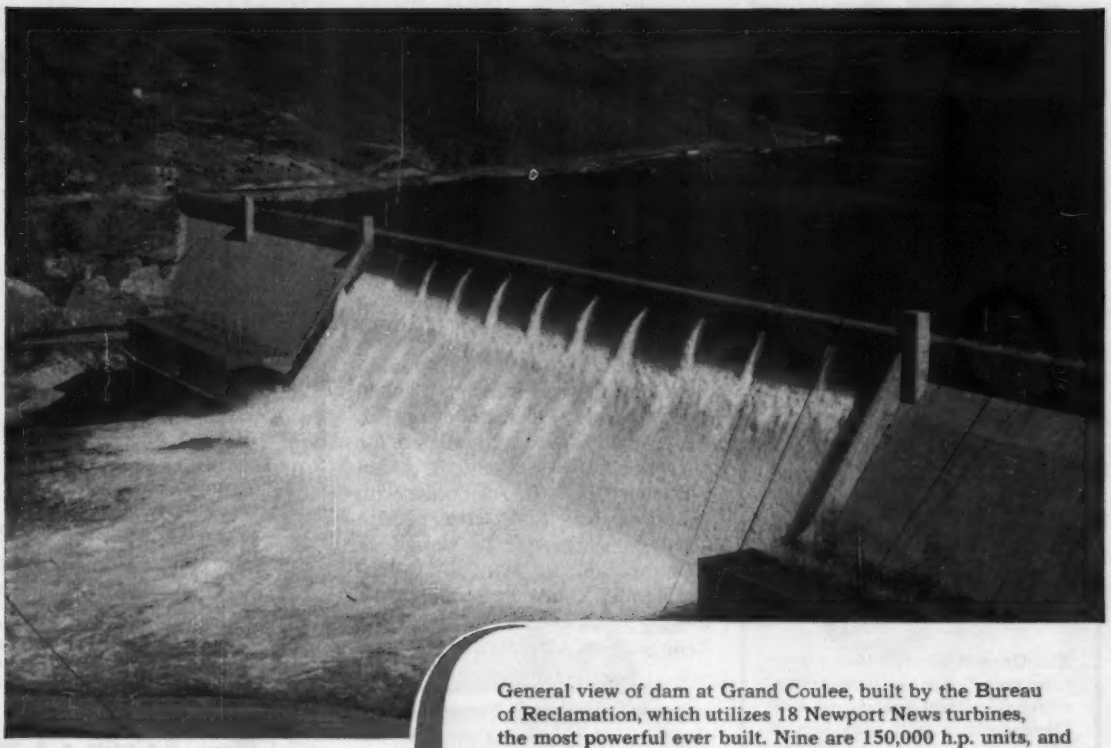
230-Kv Wood H-Frames

(Continued from page 70)

high points on the conductor surface become points of high concentration of radio influence voltage.

Under tension stringing, however, the conductor never touched the ground. This was accomplished by use of a power-driven winch at one end of the conductor run and a tensioning device at the other.

The steel winch cable was threaded through running blocks suspended from the insulator strings on each structure. The cable was then attached to the conductor and rewound, pulling the conductor into position. After the run was completed, a compression splice was made, restraining tension was eased off gradually, and the resulting slack taken up by the pulling machine. This held the entire conductor run in the air ready to be sagged.



General view of dam at Grand Coulee, built by the Bureau of Reclamation, which utilizes 18 Newport News turbines, the most powerful ever built. Nine are 150,000 h.p. units, and the other nine are rated at 165,000 h.p. each.

Specialists ... in building Water Power Equipment

Typical Users of Newport News Equipment

PLANT	LOCATION
Boone	Tennessee
Buchanan	Texas
Caonillas	Puerto Rico
Chief Joseph	Washington
Clark Hill	South Carolina
Deer Lake	Newfoundland
Folsom	California
Fort Patrick Henry	Tennessee
Hiwassee	Tennessee
Hoover	Nevada
J. H. Kerr	Virginia
Jim Woodruff	Florida
Lower Salmon	Idaho
Norris	Tennessee
Rock Creek	California
Santee-Cooper	South Carolina
C. J. Strike	Idaho
Whitney	Texas
Wilson	Alabama

Turbines designed and built for the world's largest development at Grand Coulee... and for other hydroelectric installations in America and various parts of the world... bespeak the skill and facilities offered by Newport News.

This trained organization has filled hydroelectric turbine contracts with an aggregate rated output of 7,000,000 horsepower.

Other equipment designed and built by Newport News includes penstocks, pressure regulators, valves, pumps, gates and rack rakes. Upon request, a copy of our illustrated booklet entitled "WATER POWER EQUIPMENT" will be sent to you.

Newport News
SHIPBUILDING AND DRY DOCK COMPANY
Newport News, Virginia

WHEN YOU NEED THEM

BUY RELIABLE STREET-LIGHTING CONTROL AT MINIMUM COST

The General Electric heavy-duty time switch is a low-cost method of reliable street-lighting control. Dependability and long service life mean you save on maintenance costs, too. These features of the TSA-40 time switch make it an outstanding buy:

- Exclusive contact shearing action breaks welds and keeps contacts clean.
- Completely weatherproof case gives protection in all climates.
- Extended temperature range allows operation in temperatures from −50 to 150°F.
- More wiring space and removable cover simplify installation and maintenance.
- Off-the-shelf delivery means you can get the TSA-40 *when you need it.*

Contact your local G-E time switch distributor or send for free bulletin today!

GENERAL ELECTRIC

SECTION A584-6
GENERAL ELECTRIC CO.
SCHENECTADY 5, N. Y.

Please send me free bulletin GEA-6468A on the TSA-40 time switch.

NAME.....

POSITION.....

STREET.....

CITY.....STATE.....

NEWS IN BRIEF

STEAM

Duke Power Co will add a 275,000-kw generating unit to its Allen Steam plant at Belmont for 1959 operation as part of its $40-million phase in the current expansion program. Also included in the plan is installation of three 230,000-v transmission lines for estimated cost of $10 million.

Construction of a $10-million plant on Coolwater Ranch is planned by **California Electric Power Co.** First 60,000-kw unit is slated for 1960 operation . . . Vern E. Alden Co, engineers, will collaborate with **American Gas & Electric Service Corp** engineers on the design of AG&E's projected 450,000-kw generating unit to be constructed at the Philip Sporn plant on the Ohio River in West Virginia.

Two Mexican utilities, subsidiaries of **American & Foreign Power Co,** have each ordered two 16,500-kw turbine-generator units from General Electric Co. Cia. Electrica Mexicana, S. A., will install two units in its Puebla station and Cia. Hidroelectrica Guanajuatense, S. A. units will be installed in the Celaya plant.

To help finance construction of a **30,000-kw plant in Managua,** a $1.6-million loan has been granted to Empresa Nacional de Lus y Fuerza autonomous government corporation of Nicaragua . . . **Argentina plans** to build a 600,000-kw, $122-million power plant to feed the power-hungry Buenos Aires area.

HYDRO

Pacific Power & Light Co has applied to Federal Power Commission for a license to construct its projected 110,000-kw $34-million Muddy development on the Lewis River. The project, with its 280-ft-high dam, is being undertaken within the agreement with Cowlitz County (Wash.) PUD dealing with joint development of the Lewis.

Corps of Engineers has completed first stage core drilling for another possible site for Green Peter multipurpose project on the Middle Santiam River of Oregon's Willamette Valley.

INDIANA STEEL & WIRE CO. MUNCIE IND. Crapo Galvanizing

Signs along the lines of *Crapo* GALVANIZED STEEL STRAND PERFORMANCE

For dependable performance . . . insist upon *Crapo* Galvanized Steel Strand. Superior tensile strength, combined with long-life, ruggedness and workability, makes *Crapo* Steel Strand first choice for guys, messenger and overhead ground wire.

The famous *Crapo* galvanizing process provides dependable protection for the steel, prolongs the expectant life of the strand.

- Low maintenance cost
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- Meets highest quality standards
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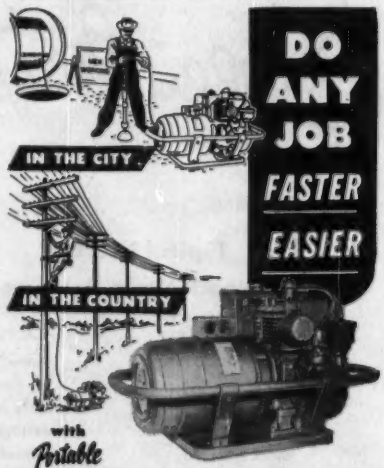
- Contact your *Crapo* Jobber—Today!

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana



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with Portable Katolight A.C. POWER

No matter where or what the job, a Katolight Portable Power Plant will simplify and speed up construction or maintenance work by supplying quick dependable electrical power right on the spot. Operates blowers, heaters, drills, hammers, saws, soldering irons, other portable electrical tools and equipment. Eliminates power line hookups.
Gasoline models from 350 Watt to 50 K.W. D.C. models 500 watt through 15 K.W. in standard voltages for portable, continuous or standby service.

IT'S NEW! SEND FOR FREE FOLDER ON NEW LIGHTWEIGHT PORTABLE MODELS

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WHEN YOU NEED THEM

JUNIOR DRAFTSMAN

SECRETARY

JUNIOR ACCOUNTANT

CASHIER

SALES REPRESENTATIVE

ENGINEER

ELECTRICIAN

JUNIOR BUYER

MACHINIST

...WILL THEY BE READY?

What kind of seniors will you hire this year from the high schools around you? Fast learners, steady workers, or...? Good schools are vital. And good schools *don't just happen*. If your company can help community groups to get better schools (population growth alone demands an extra 200,000 classrooms and 165,000 more teachers *right now*), the schools are sure to help your company. Think about it, won't you?

PUBLIC SERVICE ADVERTISING COUNCIL

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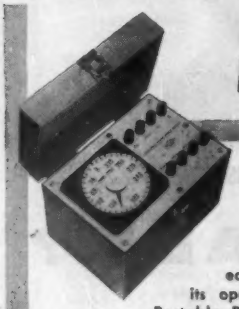
PORTABLE PHASE ANGLE METER



Completely self-contained, and requiring no auxiliary equipment for its operation, this Portable Phase Angle Meter offers a direct way of checking relay and instrument connections, particularly directional over-current relays, differential relays or similar equipment. It may also be used to measure the prevailing power factor in each phase of a polyphase watthour meter installation. The device has a frequency of 60 cycle, with voltage ranges of 60, 120 and 240 volt. Current ranges are 1, 2.5 and 5 amp. . . . DIMENSIONS: 9½ x 6¾ x 5⅝ inches. Weight 19 pounds.

Also available in other voltage combinations

Write for Bulletin #75 for complete information

EASTERN SPECIALTY CO.
PHILADELPHIA 40 PA

READERS FORUM

225 not 125 Mva

To the Editor:

In the report of the fall meeting of the EEI Transmission and Distribution Committee on page 31 of the Nov. 19, 1956 issue, I am quoted as having stated that our new 2,000-MCM pipe type cable will be rated to carry 125 Mva. I would appreciate it very much if you would correct this statement at the earliest opportunity.

Please revise the statement approximately as follows:

In a discussion J. A. Pulsford of Public Service Electric & Gas Co described a 138-kv 2,000-MCM pipe cable installation under construction to carry 225 Mva. It is recognized that this rating might have to be reduced slightly in the event of a long dry heat spell.

J. A. Pulsford
Public Service Electric & Gas Co.
Newark, N. J.

Praises Conference

To the Editor:

My hearty congratulations to you and your associates on the success of your Dec. 6-7, Electric Space Heating and Heat Pump Conference.

Here is what "I took away from the meeting:"

1. The 500% to 600% increase in attendance over that of your preceding 1952 conference.
2. Colonel Taylor was the only utility executive with a kind word for space heating at the 1952 meeting, but the audience then dismissed his message as being of little importance to any company other than his own which had always had a summer peak. The 1952 attitude seemed to be: "Pshaw! who's afraid of the big bad summer peak?" or "We never had one and never will." Last month however and—four years later than it should have been—what a stampede to complement that "never-never" summer peak growth with some winter load!—any kind of load!!
3. In 1952 any manufacturer or rate man who dared suggest that zoned radiant electric heat could be sold at 50¢ to 60¢ per therm and compete with oil at 10¢ per therm or gas at 13¢ per therm—was laughed out of the room. In 1956, Mr Richards, whose company pioneered the heat-pump and electric space heating east of the Rockies, said his campaign was to be based on electric resistance heat at 51¢ per therm in competition with natural gas at 4.3¢ per therm—and nobody laughed! And:
4. Here was an audience where—by showing of hands—less than 5% of these electric space heating enthusiasts live in an electrically heated home. The only good news about this tragically bad showing is that in just four years the industry has made excellent progress in shaking the shackles of the "slide-rule" boys and has done so with an almost negligible amount of personal and factual knowledge about the advantages and annual cost of electric space heating at rates that have long been available to 70-80% of our residential and rural customers. Where could we now be if, say, only 50% of the people who are trying to sell electric heating were living with electric heat?

William S. Leffler
Engineers Associated
17 Baywater Drive
Norton, Conn.

8,630 not 8,360 Btu/Kwhr

To the Editor:

I have read with considerable interest your special report on plants utilizing supercritical steam in the Dec. 10 issue. You are to be congratulated for covering this important and timely subject in such a thorough but concise manner.

I should like to point out, however, one typographical error which appeared in the tabulated data on our Avon No. 8 Unit. In footnote 3, on page 104, you indicate that the heat rate with two turbine-driven pumps in service is 8,360 Btu/kwhr. It is with considerable reluctance that I have to indicate that the correct value should have read 8,630 Btu/kwhr.

C. A. Dauber
Cleveland Electric Illuminating Co
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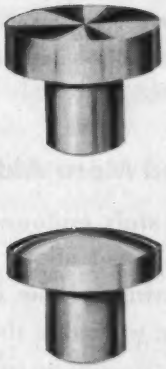

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Financial Aid to Higher Education

A Fine Start, But...

This editorial has two purposes. The first is to salute American business for the fine start it has made in helping to relieve the financial plight of our colleges and universities. The second purpose is to stress the importance of having business provide more financial aid, and soon.

How Business Helps Higher Education

Business contributions to higher education doubled between 1950 and 1955. They jumped from $40 million to $80 million. Preliminary figures indicate they will be even higher this year.

Business firms have also shown a lot of ingenuity in devising different ways of making their contributions. The methods range from a matching of an employee's contribution to his particular alma mater to wide diffusion of the money through state and regional money-raising associations of colleges and universities. Thanks to this ingenuity, business firms now have a wide choice of ways by which to give effective aid. The way most appreciated by college administrators is the making of gifts unrestricted as to the purpose for which the money is used.

Imposing as it is, however, what business has done thus far is only a good start. Only a tiny fraction of the total number of business firms in the country are giving direct financial help to our colleges and universities; and this fraction includes fewer than half of the hundred largest corporations in the country. Also, the amount of financial help being provided by business constitutes only a very small fraction of what is needed.

Why Colleges Need More Aid

Right now our privately endowed colleges and universities need about $350 million more in operating income a year than they are receiving to enable them to pay decent faculty salaries and be in tolerably good working order otherwise. The reasons, including a severe decline in the purchasing power of their endowment income because of price inflation, have been dealt with in the previous editorials in this series.

In addition, these institutions, together with the tax-supported schools, are faced with a tremendous increase in enrollment over the years ahead. With both a rapidly increasing population of young people and an increasing propor-

tion of them going to college, this year's enrollment of 3.2 million students is expected to reach 4.0 million by 1960, and to be doubled by 1970.

For the next ten years our privately supported colleges and universities must have an average of about $400 million a year above what they can be expected to collect from tuition fees, income from endowment funds, etc.

This figure of $400 million does not include what is needed for new buildings and equipment. It also does not include help for tax-supported schools above what they get from taxes, fees, etc. Business has given and will continue to give these schools substantial aid. Indeed, almost 25% of the financial help from business for our colleges and universities went to tax-supported schools in 1955.

If aid from business met their needs for increased operating income, the privately supported colleges and universities would be given a decisive lift in performing successfully their part in our system of higher education. They would still have large needs of capital equipment — buildings, dormitories, laboratories — but help from other sources, such as that provided by devoted alumni, where they are well organized, could be expected to go far toward meeting these needs. Also some companies prefer to concentrate on meeting needs of this type.

What 1% of Profits Would Do

But do business firms have the capacity to fill the gap in adequate operating income for our privately endowed colleges and universities without putting an excessive financial burden on themselves? Those who have studied this capacity carefully say that the answer clearly is yes. If, of its profits before taxes — last year an estimated $43 billion — business were to devote 1% to helping our privately endowed colleges, it would take care of present operating needs of about $350 million a year. And the balance of $80 million would be a big step in meeting their needs for new buildings and equipment, too.

About one half of a 1% contribution of this sort would, in effect, be made by the federal government. Up to a limit of 5%, contributions of this type are exempt from the federal corporate income tax. For corporations with incomes above $25,000 per year this tax is 52%.

It is clear that not all business firms are in shape to devote 1% of their profits to aid to higher education. Even in this year of record-breaking prosperity, many of them will have no profits at all. But if business generally would take 1% of pre-tax profits as a target or benchmark for financial help to our privately endowed colleges and universities these institutions would again have sturdy financial foundations.

Relatively this is a very small price to pay (1) to insure a continuing supply of competently trained young men and women and (2) to buttress our freedom by assuring the successful survival of the privately supported sector of our system of higher education.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

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Advertising in This Issue

Advertising Council, Inc. 139
Air Preheater Corp., The 19
Allen-Bradley Co. 128
Allis-Chalmers Mfg. Co. ..2nd Cover
8, 9, 104, 105
American Telephone & Telegraph Co. 125
Anaconda Wire & Cable Co. 119
Anderson Electric Corp. 97

Babcock & Wilcox Co. 44, 45
Baltimore & Ohio Railroad 16
Brown Company 114

Chevrolet Div. General Motors . 46
Coal Chemical Sales Div. United States Steel Corp. 108, 109
Cole Electric Co. 148

Directory of Engineers 146
du Pont de Nemours & Co., (Inc.) Elastomers Div. 103

Eastern Specialty Co. 140
Ebasco Services, Inc. 113
Electroline Company 15
Elliott Co. 101
Engineers, Directory of 146

Federal Pacific Electric Co. 3rd Cover
Ferranti Ltd. 14
Foster Wheeler Corp. 24, 25

General Cable Corp. 40
General Electric Co.
Apparatus Dept. ...17, 87, 88, 90 91, 93, 138
Construction Materials Div. 22, 23
Electronics Dept. 135
Lamp Dept. 111

Hazard Insulated Wire Works .. 4
Holan Corp., J. H. 115
Hubbard & Co. 107
Hubbell Inc., Harvey 110

Indiana Steel & Wire Co., Inc. .. 138
Ingersoll-Rand 12, 13
I-T-E Circuit Breaker Co.
R&IE Equipment Div. 41
Switchgear Div. 32, 33

Johns-Manville 127

KPF Electric Co. 42
Katolight Corp. 138
Kuhlman Electric Co. .....4th Cover

Lapp Insulator Co., Inc. 47
Leeds & Northrup Co. 26, 27
Line Material Co. .50, 51, 52, 53, 54

Mallory & Co., Inc., P. R. 141
Minneapolis-Honeywell Regulator Co., Industrial Div. 135
Moloney Electric Co. 20, 21

Newport News Shipbuilding & Dry Dock Co. 137

Ohio Brass Co. 39
Okonite Co., The 4
Onan & Sons, Inc., D. W. 118

P L M Products, Inc. 136
Page Steel & Wire Div., American Chain & Cable 98
Pennsylvania Transformer Co. 10, 11
Porcelain Products, Inc. 120

RT&E Corp. 112
Revere Copper & Brass, Inc. 95
Roebling's Sons Corp., John A... 48
Rome Cable Corp. 30, 31
Ryerson & Son Inc., Joseph T... 140

S&C Electric Co. 6, 7
Sangamo Electric Co. 43
Searchlight Section 144, 145
Simplex Wire & Cable Co. 18
Smith Co., S. Morgan 49
Square D Co. 99
States Company 106
Superior Switchboard & Devices Co. 136

Wagner Electric Corp. 34
Western Precipitation Corp. 133
Westinghouse Electric Corp. 28, 29, 116, 117
Wheeler Mfg. Co., C. H. 121

■

PROFESSIONAL SERVICES 146

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CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.
EMPLOYMENT OPPORTUNITIES ... 144
EQUIPMENT
(Used or Surplus New)
For Sale 145

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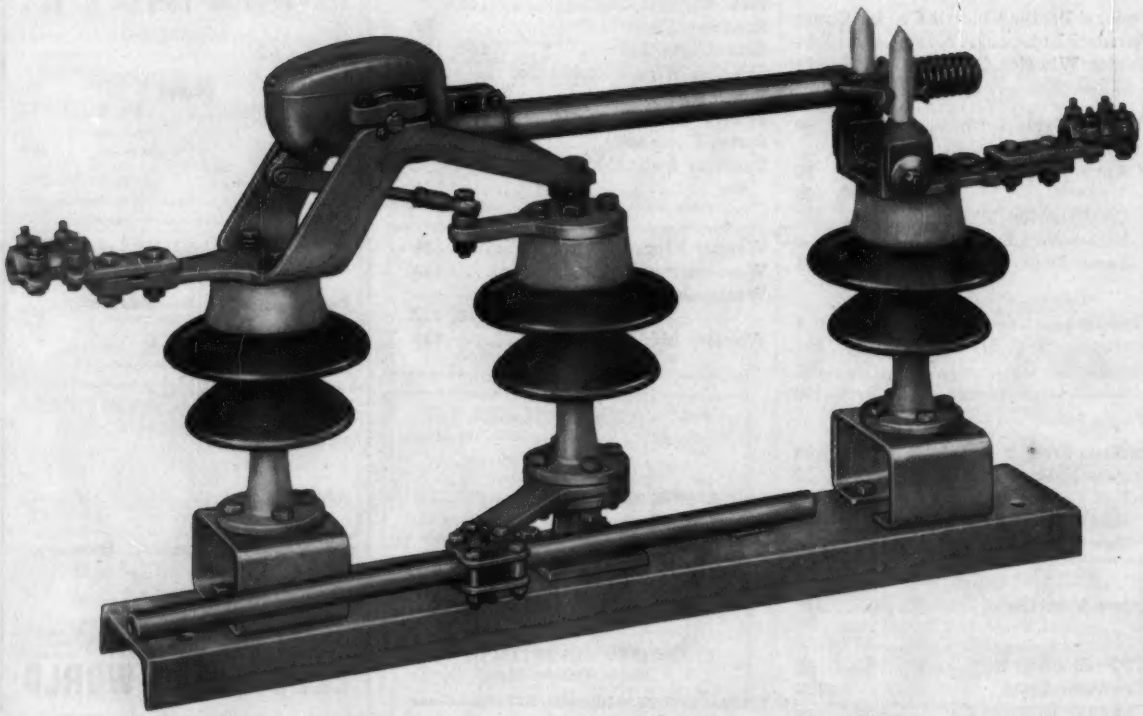
New York 36, N. Y.

Cole Electric Co.

8439 Steller Drive | TExas 0-4701 | Culver City, Calif.

Tests made in our laboratory under severe icing conditions show the switch illustrated below, closed (left) and after opening (right). Ice was over 1" thick: Only 450 inch pounds were required to open switch.



AIR BREAK DISCONNECTING SWITCH
15,000 Volts, 600 Amperes, Type 0-2
Vertical Break, Three Pole, Single Throw, Group Operated
SILVER TO SILVER CONTACTS

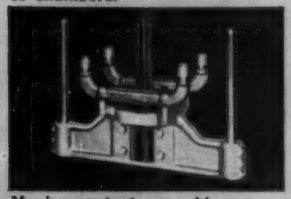
new FEDERAL PACIFIC TYPE AJ-54 oil circuit breaker

69kv, 2000 amp,
3500 and 5000 mva
5-cycle interrupting time
20-cycle reclosing time

for heaviest duty at 69 kv

ASA AND NEMA STANDARD

Arcing contacts and the 2 sets of load contacts—after removal of chambers.



Moving-contact assembly.

Interrupter assembly.

A semi-portable, compact, skid-mounted circuit breaker . . . shipped completely assembled, tested and ready to operate.

For protection of large 69-kv systems so they may keep pace with load growth, yet retain the advantage of simplified bus schemes and minimum use of current-limiting reactors.

Better because . . .

Improved expulsion interrupters — simple, 6-shoe sliding contacts; load-break and arcing-break are widely separated; no critical closed-position adjustment; no charged springs within interrupters.

Oil-hydraulic accumulator-type operating mechanism eliminates need of removing moisture and frost from lines . . . also unusually complete use of hydraulics significantly improves circuit breaker performance.

Direct-line drive — main opening springs on end of pull rod; kick-off springs at each pole.

Emergency manual closing—always at full speed and under full force.

. . . and many other features.

For complete details write: Pacific Electric Switchgear Division, Federal Pacific Electric Company, 5815 Third St., San Francisco 24, California.

Finest Products Engineered

FEDERAL PACIFIC ELECTRIC

COMPANY

50 Paris Street, Newark 1, N. J.

FPE
FEDERAL PACIFIC ELECTRIC

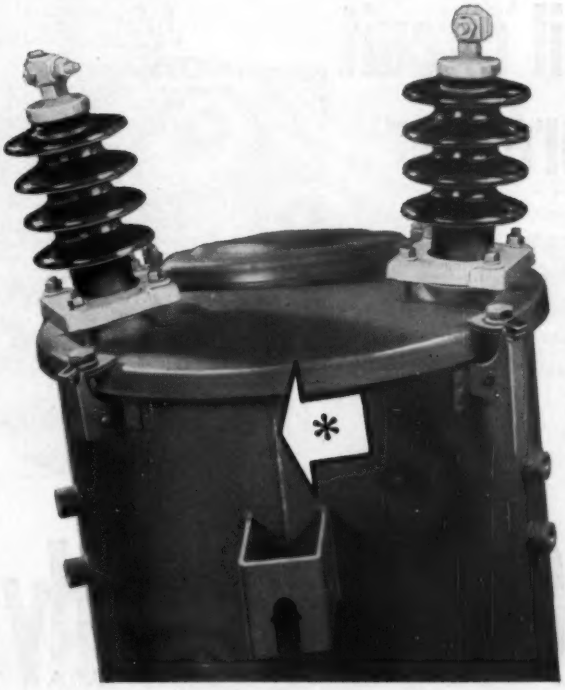
KUHLMAN "Salesman of the Week"

If you can identify this Kuhlman Electric Co. representative, and are the first one to notify Dept. SA-1, Kuhlman Electric Co., Bay City, Michigan, you will receive a valuable gift certificate. Each week a different Kuhlman representative is featured . . . watch for the Kuhlman salesman who calls on you.

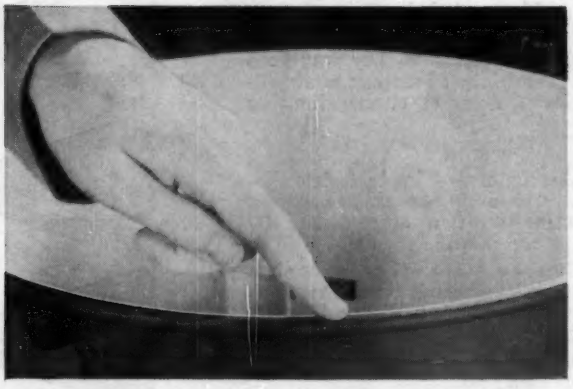
"LET ME SHOW YOU WHY

KUHLMAN TRANSFORMER TANKS ARE YOUR BEST BUY . . . . . ."

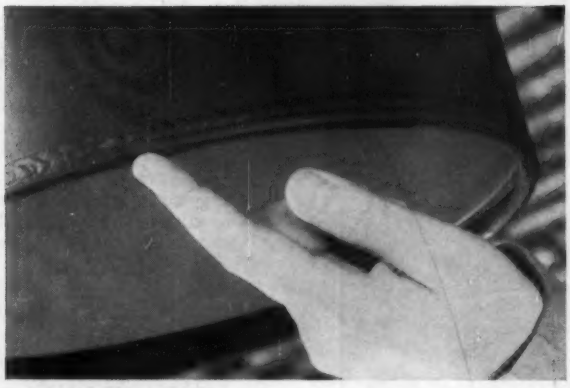
In my territory a distribution transformer tank must be leak-proof . . . air-tight . . . and rigid in construction. That's why my customers consistently order Kuhlman. They know every weld and seam of a Kuhlman tank has been factory-tested, under pressure, for oil tightness. And for all around service, they prefer Kuhlman's solid construction—moisture-proof cover fitting—and rounded tank bottom features. It will pay you to talk to your local Kuhlman representative about all the features that make Kuhlman distribution transformers your best buy.



* All welds, seams PRESSURE-TESTED



SPUN-OVER RIM—increases tank rigidity. Forms a smooth gasket seat for a moisture-proof, air-tight cover fitting.



ROUNDED BOTTOM—provides added tank strength . . . sheds moisture easily . . . forms a rugged bearing surface for handling and shipping.

575c

KUHLMAN ELECTRIC COMPANY

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